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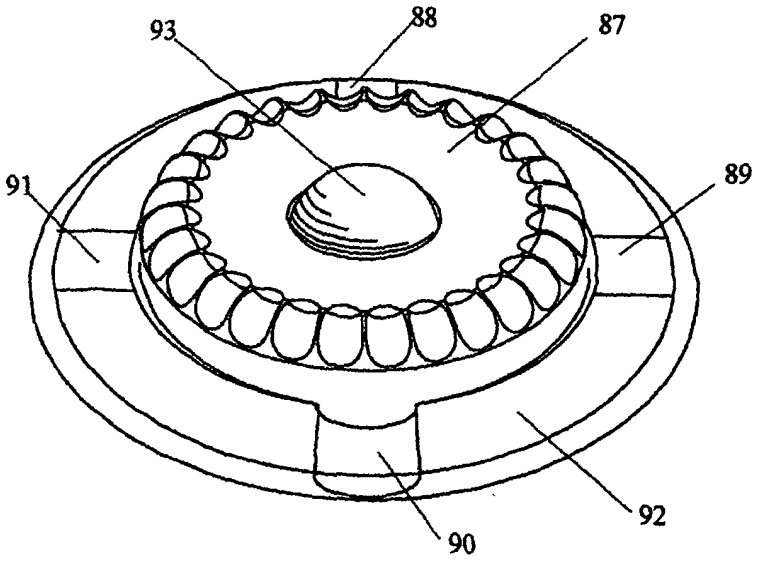
(54) Title: MANOEUVRING DEVICE FOR CONTROL OF USER FUNCTIONS IN AN ELECTRONIC APPLIANCE ENDOWED WITH A DISPLAY



(57) Abstract: An operating device for controlling user functions in electronic user equipment in cooperation with a display screen, wherein the device has a control element which is stepwise rotatable about an axis and is provided with a plurality of pressure points in order on tilting of the control element to selectively actuate switches located on a base member of the device housing, and wherein the rotation of the control element is detectable by means of sliding contacts on the underside of the control element and contact fields on the base member. The control element is encircled by a stationary, ring-shaped portion provided with a plurality of recesses which in number correspond to the position of said pressure points.

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MANOEUVRING DEVICE FOR CONTROL OF USER FUNCTIONS IN AN ELECTRONIC APPLIANCE ENDOWED WITH A DISPLAY

The present invention relates to an operating device for controlling user functions in electronic equipment in cooperation with a display screen, as indicated in the preamble of the attached patent claims.

The present invention relates not only to improvements of operating devices where the control element is roller-shaped, but also where the control element is of the sliding type or of a rotary button type.

During the course of recent years several different types of said operating devices have been developed, but the requirement of functionality and mechanical simplicity has made ever new demands on the construction of these operating devices.

Thus, it is an object of the present invention to provide further technical advances over the prior art in order to extend the functionality potential of the given types of operating devices.

The features that are characteristic of the invention in connection with the disclosed operating devices, and the respective embodiments thereof are set forth in the attached patent claims and in the following description, with reference to the attached drawings.

Fig. 1a shows a detail of the step function of a roller switch.

Fig. 1b shows an embodiment of a roller switch according to the invention.

Fig. 1c shows a modification of the roller switch shown in Fig. 1b.

Figs.1d and 1f are exploded views of the roller switch in Fig 1b.

Fig. 1f is a perspective top view of the roller switch shown in Fig. 1b and Fig. 1c.

Figs. 1g-i show a variant of the roller switch as shown in Figs. 1a-f.

Figs. 2a-2c show the tilting principle for a roller switch.

Fig, 3 shows the section III-III in Fig. 2c.

Fig. 4 shows a variant of the embodiment shown in Fig. 3 and represents the section IV-IV in Fig. 5.

Fig. 5 is a top view of the embodiment of the roller switch in Fig. 4.

Figs. 6a-6j show the design of a surrounding housing body for a roller switch solution, and Figs. 6k-6n are top views of alternative embodiments of the roller body of a roller switch.

Fig. 7 shows the design of a rotary switch with five pressure points.

Fig. 8 shows a first embodiment of the rotary switch shown in Fig. 7, i.e., in the section VIII-VIII in Fig. 9, and Fig. 9 shows the section IX-IX in Fig. 8.

Fig. 10 shows a second embodiment of the rotary switch shown in Fig. 7 and indicates the section X-X in Fig. 11, whilst Fig. 11 shows the section XI-XI shown in Fig. 10.

Figs. 12, 13, 14 and 15 show embodiments of the control element of the rotary switch with surrounding housing body.

Figs. 16a-16c are a perspective top view, a top view and a side view of a rotary switch.

Fig. 17 shows the section XVII-XVII in Fig. 16.

Fig. 18 is an exploded view of the switch shown in Figs. 16 and 17.

Figs. 19a-19c are a perspective top view, a side view and a full top view of another rotary switch.

Fig. 20 shows the section XX-XX in Fig. 19c and Fig. 21 respectively.

Fig. 21 is a top view of the switch shown in Figs. 19 and 20 and shows all the parts as transparent.

Fig. 22 is an exploded view of the rotary switch shown in Figs. 19-21.

Fig. 23 is a top view of s sliding switch.

Fig. 24 is a schematic view of the section XXIV-XXIV in Fig. 23.

Fig. 25 is a schematic view of the section XXV-XXV in Fig. 23.

Fig. 26 illustrates the pressure switches found on the slide element of the sliding switch.

Fig. 27 shows the section XXVII-XXVII in Fig. 26.

Figs. 28a-28c show the control element of the sliding switch in a tilted position, in a depressed position and in a neutral position, respectively.

Figs. 29a-29e show details of a multifunction switch of the sliding switch type which has force feedback.

Figs. 30a-30j show details of a variant of the embodiment shown in Fig. 29.

Figs. 31a and 31b show details of a rotary switch with force feedback.

Figs. 32a and 32b show details of a multifunction switch of the roller type which has force feedback.

Figs. 33-59 show as a non-limiting example different configurations of the control element/roller in a multifunction switch of the roller type.

Figs. 60a-h show a four-way tilting switch with a central roller element.

Figs. 61a-c show a combined step and detection element.

Figs. 1b-1e show an embodiment of a roller switch 1 which has three pressure points to permit selective activation of three pressure-operated switches indicated by the reference numerals 2, 3, 4 in Fig. 1d and by the same reference numerals in Figs. 1b and 1c. The roller switch is suitably mounted in a frame 5 which supports the roller element 6. Depression at a selected depression point will cause the frame 5 to move in such manner that this depression is registered by one of the switches 2-4.

One of the important aspects of the illustrated embodiment is a spring 7 which is biased towards cutouts or radial ribs in one end 6' of the roller element. These cutouts or radial ribs may be on a disc, as indicated in Fig. 1a by the reference numeral 8. The stepwise movement that the spring will give on rotation also includes means for simple adjustment of the spring force that is in effect, and that the spring can be changed to alter the physical feedback that the user will feel when the roller rotates. It will, for example, be natural to use a weaker spring 7 in a roller switch for a hand-held apparatus than it would be possible to use in connection with the control of car functions. A roller switch of this type will inevitably be larger for use in a vehicle than a roller switch adapted to, for example, a mobile telephone. In a vehicle, the space available for a roller switch will not be so critical, and the use of such a roller switch in vehicles will inevitably be rougher, so that the spring force will have to be greater.

The frame in the illustrated construction is made so that it just extends past the level of the shaft 9 in the switch, which provides a structural solution that enables the switch to be lowered in relation to, for example, a housing body for a telephone. Nevertheless it will be easy to operate the switch, even with tilting functions which will require a certain distance from such a housing body.

To sense the rotational position electrically there are provided, for example, sliding contacts 10, 11 which are connected via wiring 12 to a signal processor 13. As shown in Fig. 1b, the spring 7 can be secured to the frame structure by screws 14 which pass through screw holes 7', 7".

The illustrated construction has facilitated a solution in which an almost sealed structure has been made at each end of the roller 6, since both the stepwise spring following indicated by the spring 7 and the end piece 8, and also the rotation detection 10, 11 have permitted an "encapsulated" solution.

The spring solution shown in Fig. 1b for the stepwise movement of the roller can also be made so that it becomes a part of the end piece 5' of the frame, as indicated in Fig. 1c. This also facilitates a solution for easy replacement of a spring 15. As shown in Figs. 1d-1e, the frame may consist of a first frame member 5" and a second frame member 5"', where these frame members are tiltably arranged relative to a bottom piece 16.

A variant of a roller switch will be shown in connection with Figs. 1g-i. In this variant, the stepwise rotation is caused by projections on a disc element 8'. In this solution, the disc element 8' will also provide detection of the rotational movement of a roller element 6". Detection on rotation will be described in more detail in connection with Figs. 60k-n. The roller element 6" contains a spring 7' which loads a ball 10' that rests against the disc element 8'. A contact element 11' forms an electrical connection between the ball and the disc element. On rotation, the ball will move across the projections of the disc element, thereby creating steps and detection of the rotational movement. A shaft is formed by a pin 9' and a pin 9" on the element 11'. The pin 9" forms rotatable engagement with a hole 8" on the disc element 8'. The roller element rests in a frame consisting of the parts 5.1 and 5.2. The frame is mounted in a joint consisting of a ball 21' and a socket 21". This gives a free tilting movement of the construction for activation of switch functions at 2', 3' and 4'. Twisting and upward movement is limited by pins 20' and 20" and anchor part 31"" which is attached to a printed circuit board 16' or another fixed part of the construction. The reference numeral 12' refers to a contact for transmission of signals from the disc element 8' to a printed circuit board 16'.

Figs. 2a-2c and Fig. 3 show how a roller switch in general could have a controlled tilting relative to a frame structure, pressure-operated switches and a support housing. A roller 12 is shown which is rotatably supported about a shaft 18 that is secured to a cradle 19. Supporting pins 20, 21 are provided and extend into the cradle 19, so that the cradle 19 is not movable in the direction of the shaft 18, but will be tiltable relative to the operating device housing 22. From Fig. 3 it can be seen that one of the pins 21 projects into a hole 21' in the cradle 19 with a small clearance, whilst the pin 20 projects into a hole 20' in the cradle 19 with a large clearance. This means that the cradle 19 will be downwardly tiltable as indicated by the arrow 23. The housing 22 has a base part 22' and side members 22" and 22"'. Central depression of the roller 17 will cause the cradle 19 to move downwards, as shown by the arrow 23, whereby a switch 24 is activated. If the roller 17 is pressed down as shown in Fig. 2b, a switch 25 will be activated. Similarly, a switch 26 will be activated if the roller 17 is depressed at the area indicated by 17'.

Figs. 4 and 5 show an alternative support solution with a roller switch where there is a roller 27 that is supported in a cradle 28 via a spindle 29. Supporting pins 30, 31 are present to provide a depression function and a tilting function. The cradle will be spring-loaded from the underside, partly by the spring action from switches 32, 33, 34

and by spring action from an anti-twist element 35 which via holes 35', 35" engages with pins on the underside of the cradle 28, as indicated, for example, by the pin 28'. Springing 30' and 31' can be provided on the upper side of the cradle between a flange 30" and 31", and a respective surface portion of the cradle 28, indicated respectively by the reference numerals 28" and 28'". The elements 30, 31 are suitably anchored in a base member 36.

Figs. 6a-6i show how a housing around a roller switch may be designed. Figs. 6a, 6b and 6d-6i show typical sections of a roller switch as illustrated by the section A-A in Fig. 6c. In connection with a roller switch having a roller 37 which is to be mounted deeply sunken in a surrounding housing 38, it is possible to provide this surrounding housing with recesses, such as the recesses 39, 40, 41, 42 shown in Fig. 6c.

In the alternative shown in Figs. 6h-6j, in addition to the recesses indicated by the reference numerals 43-46, there could be supplementary protuberances 47-50. The use of such recesses and optional protuberances will enable a user to feel his way more easily using a finger and thus more easily acquaint himself with the location of the actual depression positions, especially in those cases where the surroundings of the switch are not well illuminated. The design of these recesses and optional protuberances will of course be dependent upon the shape and size that a roller switch of this type has. To be able to use a large switch, it is possible that the finger must perhaps be used sideways to press/tilt the outer positions, and in such a case recesses 39, 40 or 43, 44; 43', 44' may be relevant. In Fig. 6i, said recesses are indicated by the reference numerals 43', 46', 44' and the protuberances are indicated by the reference numerals 49', 50'.

As can be seen from Figs. 6k-6n, the roller in the roller switch may have different designs, as indicated by the respective reference numerals 51, 52, 53, 54, and consequently the shape of the recesses is given a suitable form.

In Fig. 6, the user's finger is indicated by the reference numeral 55.

Fig. 7 shows a rotary switch 56 having five pressure points indicated by the reference numerals 57-61 in Fig. 8.

The design differs from previously known solutions in that the central switch, indicated by the reference numeral 62 in Fig. 9, is operated by a ball-shaped element 63. With

further reference also to Fig. 8, it will be seen that this means that the construction can be more compact, whilst avoiding excessive friction between the rotating outer part 64 and an opposite portion. The frame 65 surrounding the ball 63 will also function as a fixed part for the stepwise rotation of the rotating, outer part 64. The actual shape of the rotary element 64 can be designed as shown, but alternative embodiments will of course be possible. Located at the upper depression points 57-60 are respective switches 66, 67, 68, 69. The stepwise rotation of the rotatable outer part 64 is assured by means of the said frame 65 which has a toothed periphery and the spring-loaded pins 70, 71 which rest against the said periphery.

A variant of the structure is shown in Figs. 10 and 11. In this case, a central ball 72 is used as an x/y navigator in connection with free movement of a cursor on a display screen. There are rollers 73, 74 which operate pulse counters, and a supporting roller 75. A roller structure of this kind is known per se from the ball solution that is found in computer mice. However, on studying Fig. 11, it will be understood that the ball 72 is depressible against a centrally located switch 76. Thus, it will be possible to use the ball 72 as a cursor control means, and on depression to activate a particular function after the ball 72 has moved the cursor to lie on top of or mark an icon during x/y navigation via the rollers 73, 74. An outer rotary body 77 functions as control element in order to, e.g., move through a menu on stepwise rotation, the stepwise movement being provided by pins 70, 71 as shown in connection with Figs. 8 and 9, and which with spring force rest against a toothed periphery of a frame 78. The said control element 77 has four depression points in the illustrated example for selective operation of switches 79, 80, 81, 82. Sliding contacts 83, 84 effect registration of the stepwise movement of the control element 77. Contacts 83', 84' are located on a base member 85 of the rotary switch housing 86.

Figs. 12-15 show how a housing body for a rotary switch can basically be designed. On rotation of the rotatable control element, indicated here by the reference numeral 87, a user can find his way to the different pressure points by feeling the marked portions 88, 89, 90, 91, represented here by recesses in the housing 92 of the rotary switch. In the illustrated example, the switch has five pressure points, four of which are under the periphery of the switch control element 87, and in addition there may a central pressure point that is represented by a key or a ball 93. In this connection, reference is made to that illustrated and described in connection with Figs. 7-11. If a rotary switch is to have more pressure points than those shown in Fig, 12, it will be possible to design the switch housing, indicated by the reference numeral 94 in Figs. 13-15, with

corresponding markings of pressure points. In Fig. 13 a total of 9 pressure points are shown, where the pressure points 94-101 are at the periphery of the switch and with the addition of a central depression point 102. It will be seen that at the depression positions there are recesses 94'-101' for the first-mentioned eight pressure points 94-101. Between the depression positions, the switch housing 102 will extend up to the level of the switch control element 103, which makes it difficult to depress the switch control element at the wrong position. These intermediate elevated portions of the housing between the said recesses 94'-101' are indicated by the reference numerals 104-111 in Fig. 13.

It will be understood immediately that the number of positions at the periphery is by no means limiting for the illustrated solution, as the number of depression points may of course be varied depending on the size of the rotary switch.

Fig. 16 shows an operating device in the form of a rotary switch 112 having a rotatable control element 113 and where markings 115, 116, 117, 118 are provided in the rotary switch housing 114 to be able to mark the right depression point. In addition, there is a central depressible button 119. In Fig. 17, a section XVII-XVII (see Fig. 16c) is shown where a central switch 120 is actuated by depression of the button 119 via a connecting rod 121. An exploded view of the rotary switch shown in Figs. 16 and 17 can be seen in Fig. 18. The depression button 119 will be a non-rotatable element. The rotatable control element 113 rotates relative to a fixed element 122 through which the pin 121 extends. The element 122 which has a toothed periphery forms spring engagement with pins 123, 123', the spring action being provided by a curved spring 123". The pins 123, 123' are supported via holes 124, 124' on a supporting disc 125 which has supporting pins 126, 126' and a guide groove 126" for the spring 123". The element 125 is designed to be able to rotate. In addition, there is a combined rotation detector and spring 127 that is designed to rotate relative to the fixedly mounted housing ring 114. A non-rotatable depression element is indicated by the reference numeral 128. A contact film (non-rotatable) is indicated by the reference numeral 129 and has springs 130, 131, 132, 133 and the central spring 134. The central spring 134, together with contact points 135 on a printed circuit board 136, forms switch 120 indicated on Fig. 17. The spring 133, together with contact points 133', will form a switch; similarly, the contact points 132' together with the spring 132 will form a switch. The spring 133 and the contact points 133' thus form the switch indicated by the reference numeral 137 in Fig. 17. In Fig. 17 the reference numeral 138 denotes a O-ring.

Fig. 19 shows an alternative structure to that shown in Figs. 16-18. In this case, there is a rotatable control element 139 that is rotatable relative to a base member 140. In addition, there is a central depressible element 141 that is non-rotatable and which via a screw 142 and a pin 143 is depressible in order to actuate a centrally located contact field 144 via a contact element 145 and contact spring 146. The contact fields 147, 148, 149 , 150 could be made to selectively provide a switch function by means of contact springs 147', 148', 149, 150. These contact springs are actuatable via a non-rotatable transfer element 151 which has respective pressure points 147", 148", 149", 150", and which is actuated by depression of the rotatable control element 139, the rotation of the element 139 also causing rotation of a transition piece 152. Screws 153 secure the transition piece 152 to the control element 139. A spring 154 is fastened to the transition piece 152 and forms spring engagement with a toothed periphery 151' on a central portion 151" of the element 151. On rotation of the control element 138, the spring element 145. via its shortest arms, will also form contact with an inner contact ring 155 on the base member 140, whilst the longest arms will form contact stepwise with contact points 154, whereby stepwise rotation produced on the engagement between the toothed periphery 151' and the spring 154 will cause corresponding registration by means of the contact fields 153, 154, so that rotation of the control element 139 will give a stepwise signal output as rotation takes place.

In Fig. 20 the reference numeral 155 denotes an O-ring provided for sealing purposes.

The screws 156 shown in Fig. 22 provide the possibility for fastening to the element 151. It will be seen that the points 147"-150" are located on spring portions of the element 151, whereby even a small movement caused by the element 152 will depress a selected spring of the springs 147'-150'. Advantageously, the element 152 can have a flexible central portion.

Fig. 23 shows a multifunction switch of the sliding type having a stepwise movable control element 157. Along the movement path of the control element 157 there may be provided protuberances 158 making it easier for the user to feel where the control element is, especially under operating conditions where the ambient lighting is poor or non-existent. Depression points 159, 160, 161 162 and a central depression point 163 are indicated on the control element 157. Similarly, there are switches 164, 165, 166, 167 and the central switch 168 on the control element. The control element and the switches 164-168 are provided on a slide 169 of which the control element 157 is a part. When the control element 157 is tilted to one side, as shown in Fig. 28a, the switch 167,

for example, will be activated. Central depression of the control element 157 will cause activation of the central switch 168. In the neutral position as shown in Fig. 28c where the control element 157 is not actuated, none of the switches 164-168 will be activated.

For the sake of clarity, busbars and current contacts, and also sliding contacts to sense the stepwise movement of the control element 157 and the activation of the switches 164-168 are not shown in Figs. 23-28, as these elements are per se inessential for the understanding of the inventive idea of the illustrated subject matter.

Figs. 29-32 show solutions for so-called "force feedback" designed for multifunction switches. It is envisaged that the switch control element is to be able to give the user an indication of the point at which the control element should be depressed to activate a desired switch which is associated with execution of a recommended or suggested functional operation. This means that it is desirable that the switch should move/tilt up against the user's finger in order to make the user press on the indicated position at which the upward tilting has taken place. This can be used in those cases where it is desirable to indicate an important option in connection with a function. In such a case, the switch will be made so that this automatic movement does not trigger a function because the switch is thus depressed. This can be programmed so that detection which can be triggered by such automatic movement is out of action at the instant the automatic function comes into effect. Normal detection will thus be in operation as soon as this force feedback has been terminated and a depression at the upward tilted point takes place, whereby detection and activation of desired functionality is obtained.

For example, this solution may be relevant on a switch on a mobile telephone or in connection with a mobile telephone function is a car. The telephone rings and the switch control element thus "jumps up" in that of the positions which on depression gives "answer call". The user will be able to use this, without having to either look directly at the switch or at the interactive display function, as an indication of where he must press to activate the function. However, the system requires the user to have his finger on the switch control element to be able to feel this.

In Fig. 29 it is shown how a user in connection with a particular function that has been selected will be able to obtain an advance indication of where it is preferable to depress a control element 170. Such advance indication could be provided, for example, by using micromotors 171, 172 which have pistons 171', 171" and 172', 172" respectively. On recommended activation of the control element 170, i.e., for depression at one of the

indicated depression points 173, 174, 175 or 176, optionally depression point 177, the said pistons in connection with the motors 171, 172 will begin to operate. On recommended depression, for example, at the depression point 173, the piston 171' will tilt the operating button 170' of the control element up at this point in order to indicate this. To be able to sense the operation of the switches and at the same time be able to activate the motors selectively by moving respective pistons either up or down, the switch device may be provided with busbars 178, a common bar 179 and bar 180 which together with contact points 181 give a signal of the stepwise movement of the control element 170. The operating button 170' of the control element 170 is associated with a slide 182 and can activate, for example, selectively one of four switches, such as the switches 183, 184 via a spider 185. A centrally located switch 186 is actuated via a centrally located pin 187 as shown clearly in Fig. 29e.

Figs. 30a-30j show a variant of the solution shown in Fig. 29, but where the said motors 170, 172 with associated pistons have been replaced by electromagnetic or electrostatic devices, such as the device parts 188, 189 and 190, 191. Thus, a force is provided from these devices so that when it is recommended that the button 192 should be depressed as shown by the arrow 193, a force will be initiated by means of the device 188, 189, so that the button is tilted up at the point 193 whereby it is signalled that switch action should take place at a switch 194, as shown in Fig. 30a. The same will happen on depression on the opposite side. If central depression should take place for activation of switch 195, both devices 188, 189 and 190, 191 will be activated. A situation of this kind is indicated by way of example in Fig. 30b.

As shown in Figs. 30d-30j, a number of the said devices 189 and 191 are provided along the outside of the movement path of the slide 196. Advantageously, three device parts 188', 188", 188"' and 190', 190", 190"' are provided on the underside of the control element switch button 192. It will be seen that depending on how it is proposed that the switch button 192 of the control element should be tilted/depressed at pressure points 197-201, two and two or four of said device parts will be activated.

On recommended depression at the depression point 197, the element parts 188", 190"' will be active in connection with subjacent parts 189, 191, so that the point 197 is raised. On recommended depression at the depression point 198, it will be the element parts 188', 188"' that enter into cooperation with respective subjacent device parts 189. On recommended depression at depression point 199, it will be, as shown in Fig. 30f, the parts 188', 190' that are activated together with subjacent respective parts 189, 191.

On recommended depression at depression point 200, it will be the device parts 190', 190''' that are activated together with subjacent device parts 191 in order to signal this pressure point. However, on recommended central depression, as indicated in Fig. 30j, at depression point 201, all four element parts 181', 181''', 190', 190''' will cooperate with respective subjacent device parts 189, 191 to lay the control element 192 horizontal.

It will be seen that recommendation as regards pressure points could be given in any of the possible stepwise positions that the operating button 192 of the control element together with the slide 196 takes up.

Fig. 31 shows a previously described rotary switch, indicated in the figure by the reference numeral 202 for the sake of simplicity. Here, it is suggested that the message regarding recommended depression point should be given using micromotors 203, 204 and whose function corresponds to that shown and explained in connection with Fig. 29. However, it should be understood that electromagnetic or electrostatic means as shown in connection with Fig. 30 could replace the illustrated micromotors 203, 204 and their respective pistons 203', 204'. In the solution shown in Fig. 32 which shows a previously described roller solution, micromotors 207, 208 and respective pistons 207', 208' are arranged against the roller switch 205 cradle underside 206' on the cradle 206 for piston movement which tilts up one end or the other to signal the end of the roller switch that should be depressed to activate an associated switch function, or activation of both pistons to signal that central depression is recommended. On recommended end depression, either the motor 207 or the motor 208 will begin to operate, whilst on recommendation of central depression both motors 207 and 208 will begin to operate.

Figs. 33-59 show different configurations of the control element in the form of a roller which is a part of an operating device of the roller switch type. An operating device of this kind is as previously mentioned suitable for controlling user functions in electronic user equipment which has a display screen, wherein the device has the stepwise rotatable, roller-shaped control element arranged in a cradle, and wherein the control element via the cradle has a plurality of pressure points in order on downward tilting or depression of the control element to selectively actuate switches located on the device housing and facing the underside of the cradle.

To make it easier for the user to feel his way to the right depression point on such a roller, especially if ambient lighting is poor or non-existent, it may be important to

shape the contour and surface of the roller based on it being selected, for example, from the group:

- steadily or gradually increasing diameter towards the centre seen in the longitudinal direction;
- steadily or gradually decreasing diameter towards the centre seen in the longitudinal direction;
- steadily or gradually decreasing diameter towards the centre seen in the longitudinal direction, but with a ring or collar around the central portion;
- stepwise different diameter seen in the longitudinal direction, for example, three fields where the central field has the smallest diameter;
- rippled contour;
- three fields of equal diameter, but having a narrowed portion between adjacent fields;
- three fields where the outermost fields are inwardly curved, and the central field is outwardly curved;
- three fields which are all inwardly curved.

On the actual surface, the roller may have as a supplement elements or markings, for example, selected from the group:

- circumferential ribs;
- studs or pins in a ring pattern around the periphery of the control element;
- ribs equally spaced in the longitudinal direction of the control element;
- cutouts, ribs or dimples arranged equidistantly around the periphery of the control element thereby forming at least two ring patterns.

As shown and described earlier, a control element of this kind may be rotatably supported about a spindle in a cradle that is supported by three spring-equipped switches, wherein one of the switches is located on one side of the spindle and the two other switches are located on the opposite side of the spindle, wherein central depression of the control element is designed to activate a switch arranged centrally on the base member, and wherein the rotation of the control element is detectable.

The following will describe a switch solution consisting of a rotating switch element supported in a tilting part for activation of four switches.

Figures 60a-c show a switch solution consisting of a roller element 221 and a tilting element 228, consisting of the parts 228' and 228". The tilting element moves about a central ball element 234 which forms a midpoint for the element 228. The ball element

234 rests in the centre part 236 which in turn is fastened to an associated fixed part of the apparatus it is to control, shown here fastened to a printed circuit board 238. The tilting element 228 has four projections or "blocks" 222, 223, 224 and 225 which form touch points for tilting the tilting element. A frame 230 lies around the structure with holes 222'-225' for the touch points 222-225. On tilting, a selected one of four small pins under the tilting parts 228', 228", such as pin 229 (the other three pins are not marked with reference numerals in Fig. 60b) will activate switch functions at springs 240-243 and contact points 244-247. As shown in Figs. 60c and 60d, the touch points 222-225 are related to respective pins 229-229'". Rotation of the roller element 221 is detected in that a spring-loaded ball 250 runs over projections on the detection element 252. At the same time the stepwise movement will be generated. A further description of this step movement function will be given in connection with Fig. 61. Orientation of the tilting direction and touch points for the switch solution is shown in two ways in connection with Figures 60c-h. Figures 60c-e show that the tilting directions are oriented respectively along the axis of rotation and transverse thereto. Figures 60g-h show how the tilting direction may alternatively be oriented, diagonal relative to the axis of rotation. Reference numeral 254 in Fig. 60c shows a channel for signals generated on rotation of roller element. In one particular embodiment, as shown in Fig. 60f, it may be desirable to be able to press the roller element 221 downwards for activation of a central switch function, represented by a switch 231. Elastically yielding spacers will be disposed between the parts 228', 228" at the respective switch points 240-243, shown in this figure as spacers 226, 227 at the switch points 241, 243. On depression of the roller element 221, these elastically yielding spacers will be deformed slightly when the parts 228', 228" move downwards together relative to the base member or the printed circuit board 238', but not enough to cause any of the switch points 240-242 to be activated. Instead, the switch 231 will be activated. It is also possible to replace the spacers by, e.g., an O-ring (not shown).

Detection of rotation in connection with switches which have a roller element will be described with reference to Fig. 61. A detection element 260 contains a plurality of projections 262 which are supplied with electric voltage. A spring 263 and a piston 264 exert pressure on a ball 266. The ball is placed in a contact part 268 which is in contact with a centre part 269 of the detection element 260. The contact part 286 will rotate with the roller, like the roller element 6" in Figs. 1g-h or the roller element 221 in Fig. 60. Advantageously, the centre part 269 lies on an earth potential. The contact part 268 is indicated by 11' in Figs. 1g-h and by 268 in Fig. 61b. A pin 9" on the element 11', cf. the indicated pin 268' on the part 268, will form rotatable engagement with a hole 8' on

the disc element 11', cf. hole 260' on the element 260. The contact part 268 is of conductive material and conveys electric contact from the centre part to the ball 266. Fig. 61b shows detection element 260 with projections 262. The projections are connected together in groups of three. Thus, as shown in more detail in Fig. 61c, the projections 270-270" have a first and identical voltage level, the projections 271-271" have a second and identical voltage level and similarly the projections 272-272" have a third and identical voltage level. When the ball comes into contact with two of the projections, e.g., 270' and 271', a short circuit will be detected at the same time. The power supply to the respective sets of projections will take place via slip rings on the rear side of the detection element and sliding contacts that extend up from the printed circuit board 238. A technology which can be used in this connection is represented by reference numeral 12 in Figs. 1g-h, although subjected to some minor modifications which will be obvious to the skilled person. On further stepwise rotation, a new short circuit will be detected, but then between two other values. Thus, the direction and steps of the rotation will be detected at the same time. The number of projections is not limiting for the invention, but will depend upon the size of the switch, the desired number of steps and the functionality of the apparatus for which the switch is to be used.

Patent claims

1.

An operating device for controlling user functions in electronic user equipment which has a display screen, wherein the device has a roller-shaped control element that is stepwise rotatable about a shaft and provided with a plurality of pressure points in order on tilting or central depression of the control element to selectively actuate switches located on a base member of the device housing, wherein the control element is rotatably supported about a spindle in a cradle supported by three spring-equipped switches, wherein one of the switches is on one side of the spindle and the two other switches are on the opposite side of the spindle, and wherein rotation of the control element is detectable by means of equipment in association with a first of the end members of the cradle and an adjacent, first end portion of the control element, characterised in

- that the second end portion of the control element is equipped with a plurality of radially arranged projections; and
- that an adjacent, second end member of the cradle is equipped with a spring that has a spring tongue designed to rest against the second end portion and, on rotation of the control element, to successively be actuated by said projections.

2.

An operating device as disclosed in claim 1, characterised in

- that the spring constitutes an integral part of the second end member of the cradle.

3.

An operating device as disclosed in claim 1, characterised in

- that the spring is releasably secured to the second end member.

4.

An operating device as disclosed in claim 1, 2 or 3, characterised in

- that each end member of the cradle has an upper portion designed to project into a recess in the end portions of the control element.

5.

An operating device as disclosed in claim 1, 2 or 3, characterised in

- that each end member of the cradle has an upper portion designed to overlie a peripheral part of the end portions of the control element.

6.

An operating device as disclosed in one or more of claims 1-5, characterised in

- that the cooperation between the radially arranged projections and the spring is designed on rotation of the control element to give a tactile feedback of stepwise movement to a person causing the rotation.

7.

An operating device for controlling user functions in electronic user equipment which has a display screen, wherein the device has a roller-shaped control element that is stepwise rotatable about a shaft and provided with a plurality of pressure points in order on tilting or central depression of the control element to selectively actuate switches located on a base member of the device housing, wherein the control element is rotatably supported about a spindle in a cradle supported by three spring-equipped switches, wherein one of the switches is on one side of the spindle and the two other switches are on the opposite side of the spindle, and wherein rotation of the control element is detectable by means of equipment in association with a first of the end members of the cradle and an adjacent, first end portion of the control element, characterised in

- that the first end member has a disc element having a plurality of radially arranged projections capable of being supplied with respective voltage potential, and wherein the disc element has a different voltage potential; and
- that an end area of the control element which faces the disc element is equipped with an electrically conducting spring-loaded ball which on rotation of the control element stepwise forms electrically conducting engagement with an adjacent pair of projections.

8.

An operating device as disclosed in claim 7, characterised in

- that the spring is a spiral spring which in a longitudinal direction projects into said end area of the control element;
- that the spring is supported by a piston arranged axially through the spring;
- that one end of the piston abuts against the ball and a second projects into the control element; and
- that a contact element that is arranged between the control element and the disc element is rotatably connected to the disc element, encircles a portion of the ball and the piston, and is arranged to rotate together with the control element.

9.

An operating device as disclosed in claim 7 or 8, characterised in

- that the cradle is supported on the base member via a ball joint connection; and
- that arranged on the base member is an anchor member which forms movable engagement with pin(s) on the cradle for limiting upward tilting movement of the cradle and twisting of the cradle in parallel relation to the base member.

10.

An operating device as disclosed in one or more of claims 7-9, characterised in

- that the cooperation between the radially arranged projections and the spring-loaded ball is designed on rotation of the control element to give a tactile feedback of stepwise movement to a person causing the rotation.

11.

An operating device for controlling user functions in electronic user equipment which has a display screen, wherein the device has a roller-shaped control element that is stepwise rotatable about a shaft and provided with a plurality of pressure points in order on tilting or central depression of the control element to selectively actuate switches located on a base member of the device housing, wherein the control element is rotatably supported about a spindle in a cradle supported by three spring-equipped switches, wherein one of the switches is on one side of the spindle and the two other switches are on the opposite side of the spindle, and wherein rotation of the control element is detectable by means of equipment in association with a first of the end members of the cradle and an adjacent, first end portion of the control element, characterised in

- that the cradle is supported on the base member via a ball joint connection; and
- that arranged on the base member is an anchor member which forms movable engagement with pin(s) on the cradle for limiting the upward tilting movement of the cradle and twisting of the cradle in parallel relation with the base part.

12.

An operating device for controlling user functions in electronic user equipment which has a display screen, wherein the device has a roller-shaped control element that is stepwise rotatable about a shaft and provided with a plurality of pressure points in order on tilting or central depression of the control element to selectively actuate switches

located on a base member of the device housing, wherein the control element is rotatably supported about a spindle in a cradle supported by three spring-equipped switches, wherein one of the switches is on one side of the spindle and the two other switches are on the opposite side of the spindle, and wherein rotation of the control element is detectable by means of equipment in association with a first of the end members of the cradle and an adjacent, first end portion of the control element, characterised in

- that the cradle is connected to the housing via two supporting pins which extend transverse to the axis of the roller, one of the pins having at one end thereof larger support clearance in the direction of depression than the other pin.

13.

An operating device for controlling user functions in electronic user equipment which has a display screen, wherein the device has a roller-shaped control element that is stepwise rotatable about a shaft and provided with a plurality of pressure points in order on tilting or central depression of the control element to selectively actuate switches located on a base member of the device housing, wherein the control element is rotatably supported about a spindle in a cradle supported by three spring-equipped switches, wherein one of the switches is on one side of the spindle and the two other switches are on the opposite side of the spindle, and wherein rotation of the control element is detectable by means of equipment in association with a first of the end members of the cradle and an adjacent, first end portion of the control element, characterised in

- that the cradle is movably mounted relative to two posts projecting up from the base member; and
- that a resilient, cradle-anti-twist member is arranged between the underside of the cradle and the base member.

14.

An operating device for controlling user functions in electronic user equipment which has a display screen, wherein the device has a roller-shaped control element that is stepwise rotatable about a shaft and provided with a plurality of pressure points in order on tilting or central depression of the control element to selectively actuate switches located on a base member of the device housing, wherein the control element is rotatably supported about a spindle in a cradle supported by three spring-equipped switches, wherein one of the switches is on one side of the spindle and the two other switches are on the opposite side of the spindle, and wherein rotation of the control

element is detectable by means of equipment in association with a first of the end members of the cradle and an adjacent, first end portion of the control element, characterised in

- that the upper portion of the operating device is covered by a housing portion in such manner that the control element projects up from the upper face of the housing portion at a distance equal to or less than a quarter of the diameter of the control element.

15.

An operating device as disclosed in claim 14, characterised in

- that at the depression areas of the control element recesses are provided in the upper face of said housing portion.

16.

An operating device as disclosed in claim 14 or 15, characterised in

- that at each end of the control element a recess is provided in the upper face of said housing portion.

17.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a control element that is stepwise rotatable about an axis and is provided with a plurality of pressure points in order on tilting of the control element to selectively actuate switches located on a base member of the device housing, and wherein the stepwise rotation of the control element is detectable by means of cooperation between sliding contacts on the underside of the control element and contact fields on the base member,
characterised in

- that the operating device is equipped with a switch located centrally on the base member, the central switch being actuatable by a depressible ball-shaped key which projects up through a central hole in the control element with less than half of the ball surface.

18.

An operating device as disclosed in claim 17, characterised in

- that the ball-shaped key is rotatably supported by two x/y coordinate sensors made in the form of rollers and which on following the rotation of the key emit x and/or y related signals;

- that an additional roller is arranged to provide together with the rollers of said sensors a three-point support of the key; and
- that the sensors and said roller rest in a frame which is spring supported by the central switch.

19.

An operating device as disclosed in claim 16 or 17, characterised in

- that the operating device is equipped with a centrally arranged switch on the base member, the centrally arranged switch being actuatable by a depressible ball-shaped key which projects up through a central hole in the control element with less than half of the ball surface.

20.

An operating device as disclosed in claim 17, 18 or 19, characterised in

- that the control element is encircled by a stationary, ring-shaped portion provided with a plurality of recesses which in number correspond to the position of said pressure points.

21.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a control element that is stepwise rotatable about an axis and is equipped with a plurality of pressure points in order on tilting of the control element to selectively actuate switches located on a base member of the device housing, and wherein the stepwise rotation of the control element is detectable by means of sliding contacts on the underside of the control element and contact fields on the base member, characterised in

- that the control element is encircled by a stationary, ring-shaped portion provided with a plurality of recesses which in number correspond to the position of said pressure points.

22.

An operating device as disclosed in claim 20 or 21, characterised in

- that arranged between the recesses on the stationary, ring-shaped portion are raised markings;
- that on the surface of the control element there is a plurality of radially arranged projections; and

- that the number of recesses, the number of raised markings and the number of radially arranged projections are the same.

23.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a control element that is stepwise rotatable about an axis and is equipped with a plurality of pressure points in order on tilting of the control element to selectively actuate switches located on a base member of the device housing, and wherein the stepwise rotation of the control element is detectable by means of cooperation between sliding contacts on the underside of the control element and contact fields on the base member, characterised in

- that the sliding contacts are arranged on a rotatable, ring-shaped body that is equipped with resilient contact tongues.

24.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a control element that is stepwise rotatable about an axis and is equipped with a plurality of pressure points in order on tilting of the control element to selectively actuate switches located on a base member of the device housing, and wherein the stepwise rotation of the control element is detectable by means of cooperation between sliding contacts on the underside of the control element and contact fields on the base member, characterised in

- that the sliding contacts are on a rotatable, X-shaped body, wherein the contacts are placed in the outer ends of the body, and wherein two of the outer ends are at a smaller distance from the centre of the body than the two other outer ends.

25.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a control element mounted on a slide that is stepwise movable along a path and wherein the control element is equipped with a plurality of pressure points in order on downward tilting or depression of the control element to selectively actuate switches located on the slide, and wherein the stepwise movement of the control element and the activation of the switches are detectable by means of sliding contacts on the underside of the slide and adjacent contact fields on the device housing, characterised in

- that along the movement path of the control element and sideways relative to the control element there is arranged on the operating device housing a plurality of spaced-apart protuberances for marking the possible, successive step positions of the slide.

26.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a control element mounted on a slide that is stepwise movable along a path and wherein the control element is equipped with a plurality of pressure points in order on downward tilting or depression of the control element to selectively actuate switches located on the slide, and wherein the stepwise movement of the control element and the activation of the switches are detectable by means of sliding contacts on the underside of the slide and adjacent contact fields on the device housing, characterised in

- that the control element cooperates with means located on the slide which in a desired step position of the slide is designed, on upward tilting or upward movement of the control element at one of the pressure points, to give an indication of this point as preferred activating pressure point for actuation of a subjacent switch.

27.

An operating device as disclosed in claim 26, characterised in

- that said means consists of at least two motors, for example, of the step motor type, or at least two electromagnets which receive their power supply via said sliding contacts and contact fields.

28.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a control element mounted on a slide that is stepwise movable along a path and wherein the control element is equipped with a plurality of pressure points in order on downward tilting or depression of the control element to selectively actuate switches located on the slide, and wherein the stepwise movement of the control element and the activation of the switches are detectable by means of sliding contacts on the underside of the slide and adjacent contact fields on the device housing, characterised in

- that the control element on the slide cooperates with means arranged on the housing along the sliding path of the slide and sideways relative to the slide and which in a desired step position of the slide are designed on upward tilting or upward movement of

the control element at one of the pressure points to give an indication of this point as preferred activating pressure point for actuation of a subjacent switch.

29.

An operating device as disclosed in claim 28, characterised in

- that said means consist of at least two motors, for example of the step motor type, or at least two electromagnets.

30.

An operating device as disclosed in claim 28, characterised in

- that said means consist of at least two electromagnets, wherein the armature of the electromagnets forms a connection with the control element and wherein the coil part of the electromagnets with the core is arranged on the operating device housing at the stepwise positions and facing towards the underside of the outer portion of the control element.

31.

An operating device as disclosed in claim 28, characterised in

- that said means consists of at least two electrostatic devices, wherein a first part of the device is arranged on the control element, preferably on it underside at the outer side edges, and wherein a second part of the device is located on the operating device housing sideways relative to the slide at the stepwise positions and facing towards the underside of the control element, in order on a given charge to attract or repel each other.

32.

A operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a stepwise rotatable control element provided with a plurality of pressure points in order on downward tilting or depression of the control element to selectively actuate switches located on the device housing, and wherein the stepwise movement of the control element is detectable by means of sliding contacts on the underside of the control element and adjacent contact fields on the device housing, characterised in

- that the control element cooperates with a means located on the device and which in a desired step position of the control element is designed, on upward tilting or upward movement of the control element at one of the pressure points, to give an indication of this point as preferred activating pressure point for actuation of a subjacent switch.

33.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a stepwise rotatable, roller-shaped control element mounted in a cradle and wherein the control element via the cradle has a plurality of pressure points in order on downward tilting or depression of the control element to selectively actuate switches located on the device housing and facing towards the underside of the cradle, characterised in

- that the cradle cooperates with means located against the underside thereof which in a desired rotational step position of the control element is designed, on upward tilting or upward movement of the cradle, and thus the control element at one of the pressure points, to give an indication of this point as preferred activating pressure point for actuation of a switch that is related to an activating pressure point.

34.

An operating device as disclosed in claim 32 or 33, characterised in

- that said means are selected from the group consisting of:
  - at least two motors, for example of the step motor type;
  - at least two electromagnets;
  - at least two electrostatic devices.

35.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a stepwise rotatable, roller-shaped control element mounted in a cradle and wherein the control element via the cradle has a plurality of pressure points in order on downward tilting or depression of the control element to selectively actuate switches located on the device housing and facing towards the underside of the cradle, characterised in

- that the form of the roller-shaped control element is selected from the group:
  - gradually decreasing diameter towards the centre seen in the longitudinal direction;
  - gradually decreasing diameter towards the centre seen in the longitudinal direction, but with a ring or collar around the central portion;
  - stepwise different diameter seen in the longitudinal direction, for example, three fields where the central field has the smallest diameter;
  - rippled contour;
  - three fields of equal diameter, but having a narrowed portion between adjacent

fields;

- three fields where the outermost fields are inwardly curved, and the central field is outwardly curved;
- three fields which are all inwardly curved.

36.

An operating device as disclosed in claim 34, characterised in

- that arranged on the surface of the control element are elements selected from the group:
  - circumferential ribs;
  - studs or pins in a ring pattern around the periphery of the control element;
  - ribs spaced equally spaced in the longitudinal direction of the control element;
  - cutouts, ribs or dimples arranged equidistantly around the periphery of the control element thereby forming at least two ring patterns.

37.

An operating device as disclosed in claim 35 or 36, characterised in

- that the control element is rotatably supported about a spindle in a cradle supported by three spring-equipped switches, wherein one of the switches is on one side of the spindle and the two other switches are on the opposite side of the spindle, wherein central depression of the control element is designed to activate a switch centrally located on the base member and wherein the rotation of the control element is detectable.

38.

A roller-shaped control element for use in an operating device for controlling user functions in electronic user equipment which has a display screen, characterised in

- that the form of the roller-shaped control element is selected from the group:
  - steadily or gradually increasing diameter towards the centre seen in the longitudinal direction;
  - steadily or gradually decreasing diameter towards the centre seen in the longitudinal direction;
  - steadily or gradually decreasing diameter towards the centre seen in the longitudinal direction, but with a ring or collar around the central portion;
  - stepwise different diameter seen in the longitudinal direction, for example, three fields where the central field has the smallest diameter;
  - rippled contour;

- three fields of equal diameter, but having a narrowed portion between adjacent fields;
- three fields where the outermost fields are inwardly curved, and the central field is outwardly curved;
- three fields which are all inwardly curved.

39.

A roller-shaped control element as disclosed in claim 38, characterised in
- that arranged on the surface of the control element are elements selected from the group:
  - circumferential ribs;
  - studs or pins in a ring pattern around the periphery of the control element;
  - ribs equally spaced in the longitudinal direction of the control element;
  - cutouts, ribs or dimples arranged equidistantly around the periphery of the control element thereby forming at least two ring patterns.

40.

A roller-shaped control element as disclosed in claim 38 or 39, characterised in
- that the control element is designed to be rotatably supported about a spindle which forms a part of the operating device, wherein the cradle is supported by three spring-equipped switches, wherein one of the switches is on one side of the spindle and the two other switches are on the opposite side of the spindle, wherein central depression of the control element is designed to activate a switch centrally located on the base member and wherein the rotation of the control element is detectable.

41.

An operating device for controlling user functions in electronic user equipment that has a display screen, wherein the device has a roller-shaped control element that is stepwise rotatable about a shaft and wherein the device has a plurality of pressure points in order on tilting of the device or on central depression to selectively actuate switches located on a base member of the device housing, wherein the control element is rotatably supported about a spindle in a cradle that is supported by spring-equipped switches, wherein the cradle is tiltable relative to the base member, and wherein the stepwise rotation of the control element is detectable by means of a device in connection with a first of the cradle's end members and an adjacent, first axial end portion of the control element, characterised in

- that the cradle is supported on the base member via a ball joint connection that is located centrally on the underside of the cradle; and
- that those of the switches designed for detection of said tilting are placed on the base member at a radial distance from the ball joint connection.

42.
An operating device as disclosed in claim 41, characterised in
- that said radial distance is the same for all tilting detection switches.

43.
An operating device as disclosed in claim 41 or 42, characterised in
- that central depression of the control element is designed to activate a centrally arranged one of said switches on the base member, the said ball joint connection consisting of a first part connected to the underside of the cradle and a second part in the form of a central part placed so as to be axial movable in the base part and supported by the central switch.

44.
An operating device as disclosed in claim 41, characterised in
- that a line between radially opposite pairs of tilt detection switches forms an angle with the direction of axial rotation of the control element.

45.
An operating device as disclosed in claim 41, characterised in
- that a line between one radially opposite pair of tilt detection switches forms an angle of 0° with the direction of axial rotation of the control element.
- that a line between a second radially opposite pair of tilt detection switches forms an angle of 90° with the direction of axial rotation of the control element.

46.
An operating device as disclosed in one or more of claims 41-45,
characterised in
- that the first end member of the cradle has a disc element having a plurality of radially arranged projections capable of being supplied with respective voltage potential, and where the disc element has a different voltage potential; and
- that an end area of the control element which faces towards the disc element is equipped with an electrically conductive spring-loaded ball which on rotation of the

control element forms stepwise electrically conductive engagement with adjacent pairs of projections.

47.

An operating device as disclosed in claim 46, characterised in

- that the spring is a spiral spring which in the longitudinal direction projects into said end area of the control element;
- that the spring is supported by a piston arranged axially through the spring;
- that one end of the piston abuts against the ball and another end projects into the control element; and
- that a contact element which is located between the control element and the disc element is rotatably connected to the disc element, surrounds a portion of the ball and piston, and is designed to rotate together with the control element.

48.

An operating device as disclosed in one or more of claims 41-47, characterised in

- that the cooperation between the radially arranged projections and the spring-loaded ball is designed on rotation of the control element to give a tactile feedback of stepwise movement to a person causing the rotation.

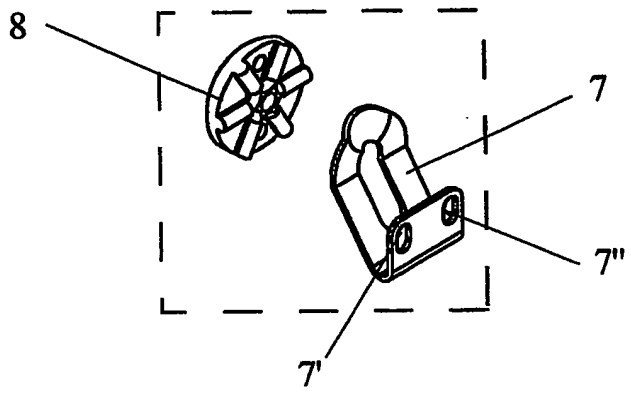

Fig. 1a

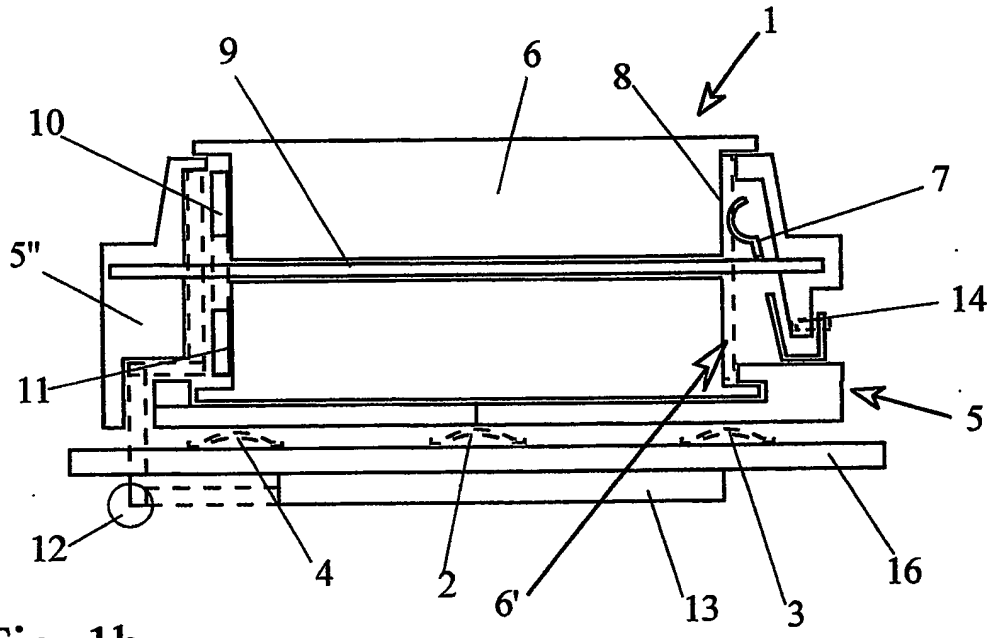

Fig. 1b

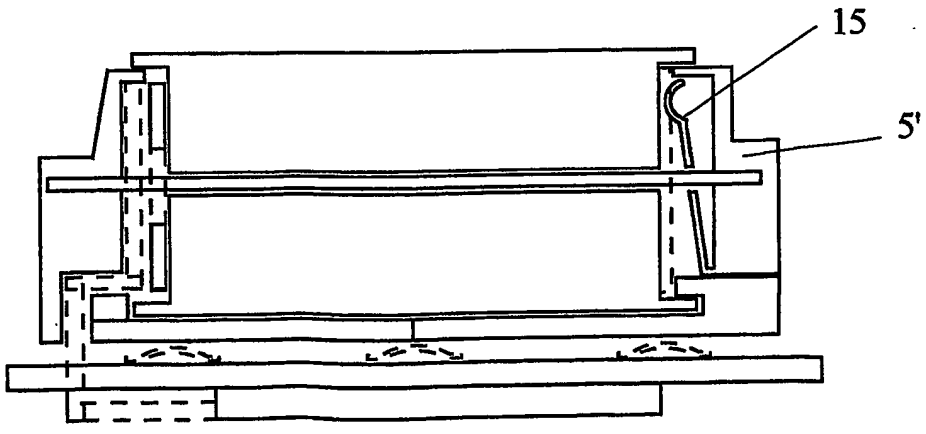

Fig. 1c

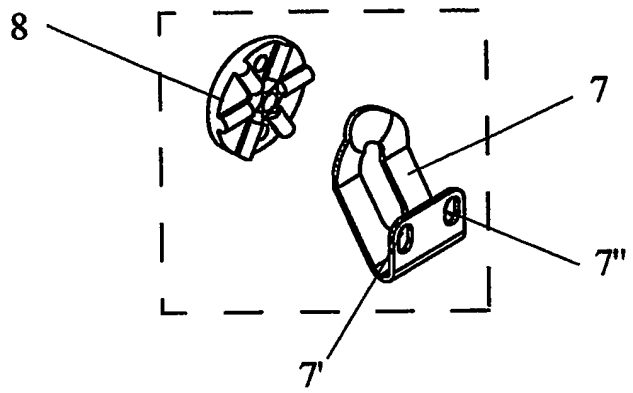

Fig. 1a

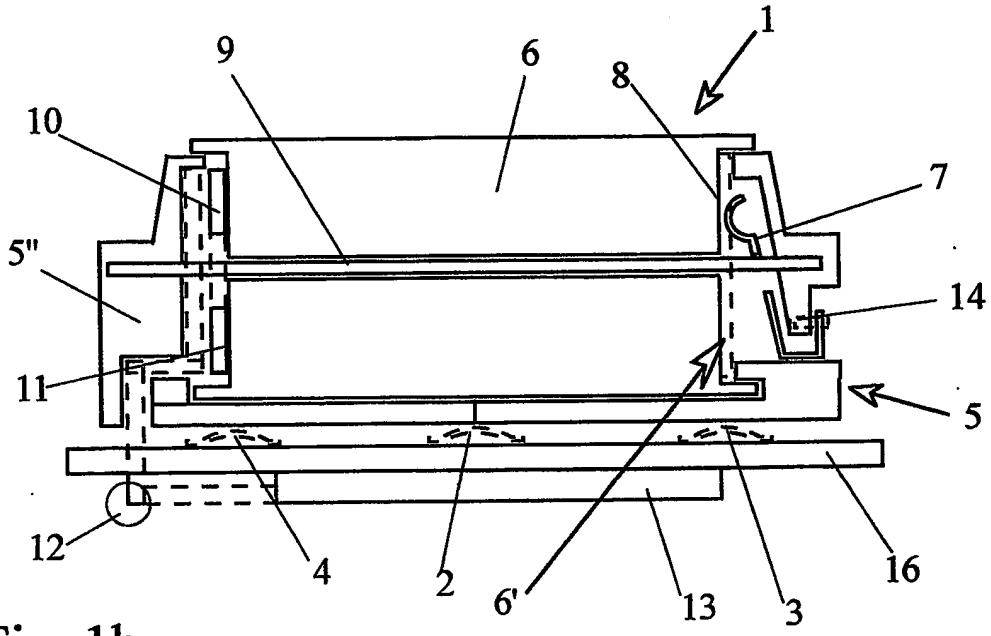

Fig. 1b

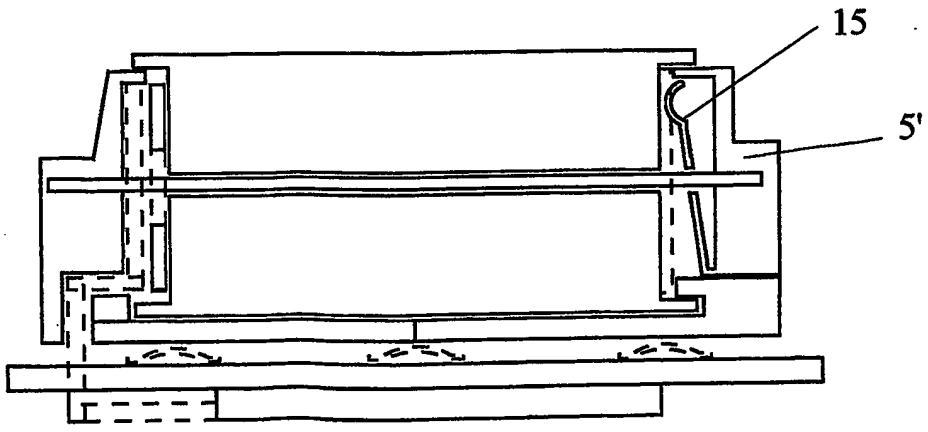

Fig. 1c

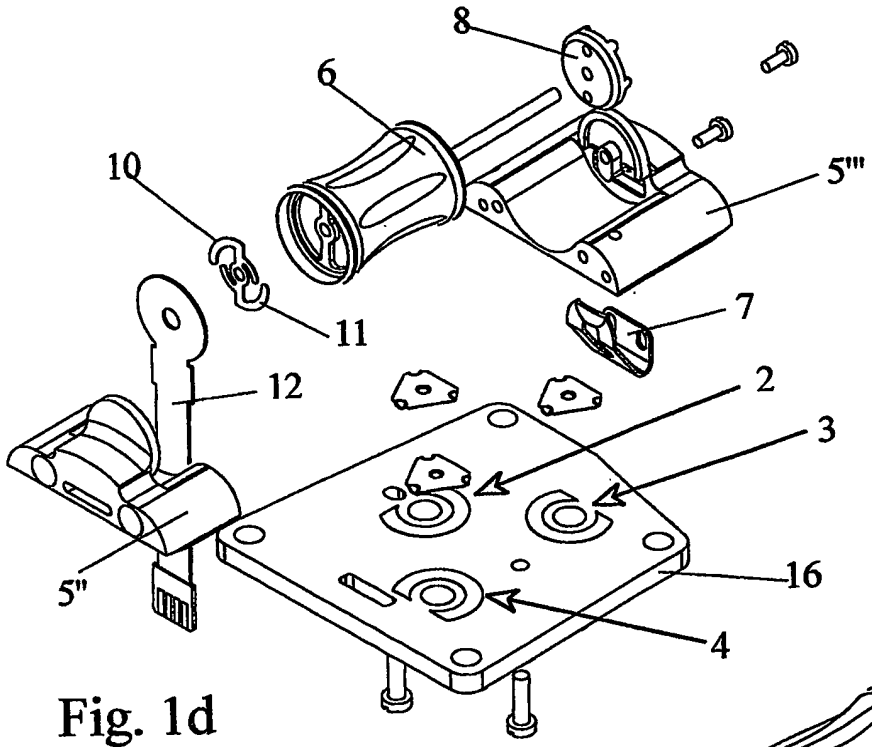

Fig. 1d

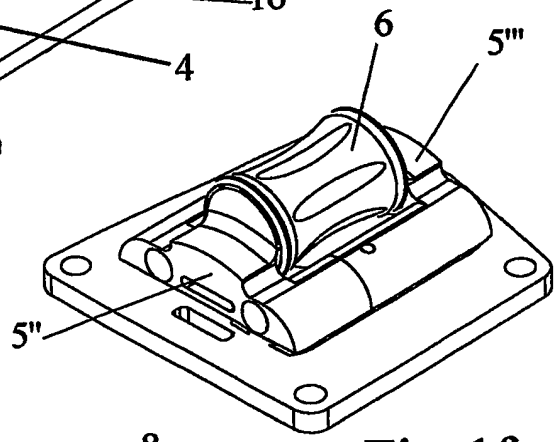

Fig. 1f

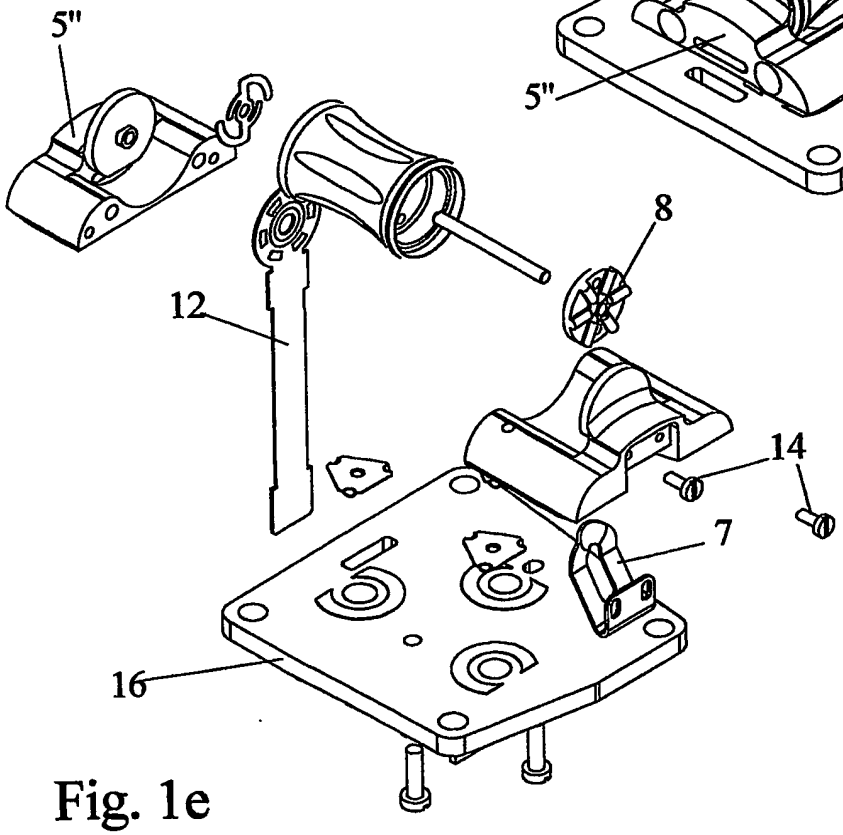

Fig. 1e

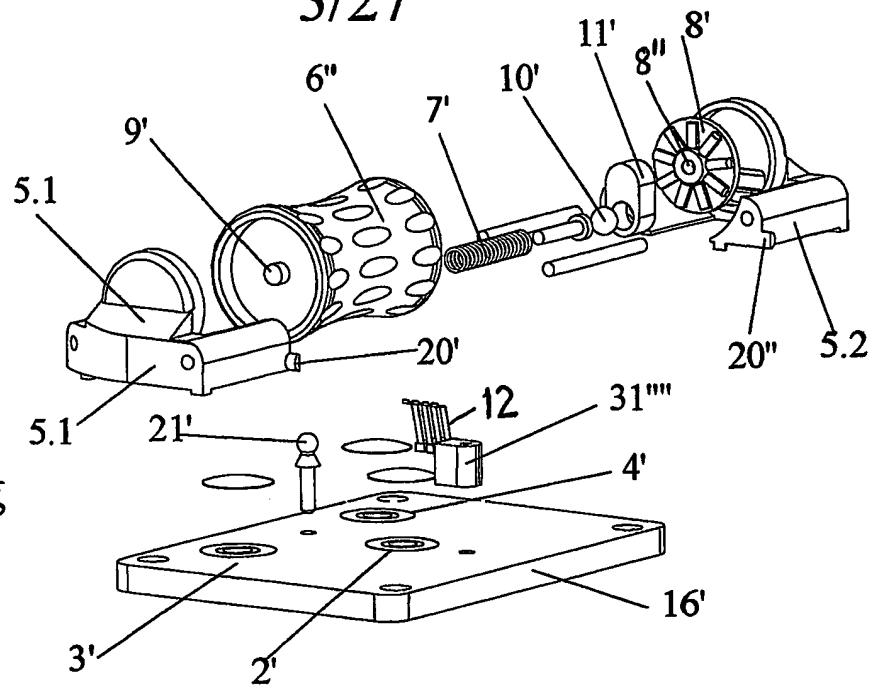

Fig.1g

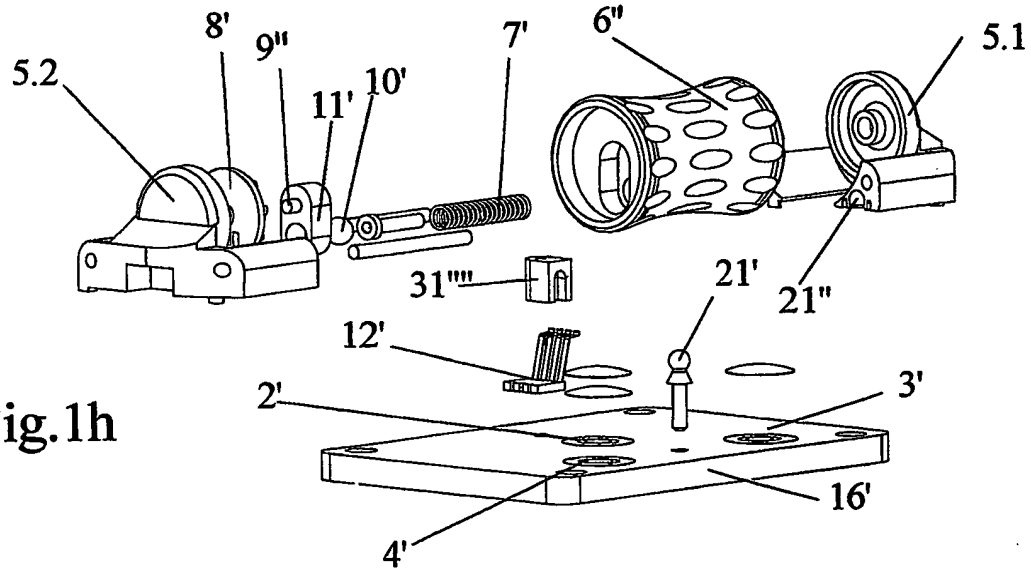

Fig.1h

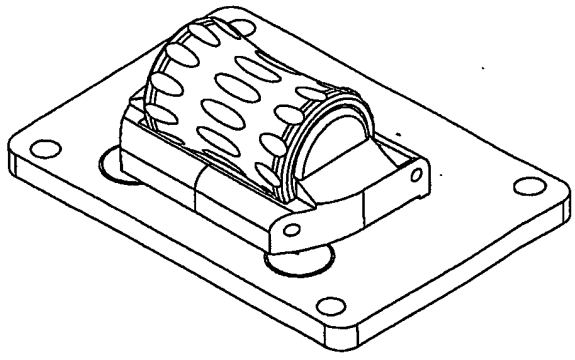

Fig.1i

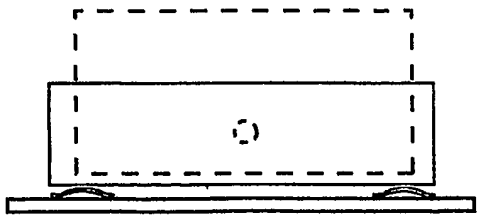

Fig. 2a

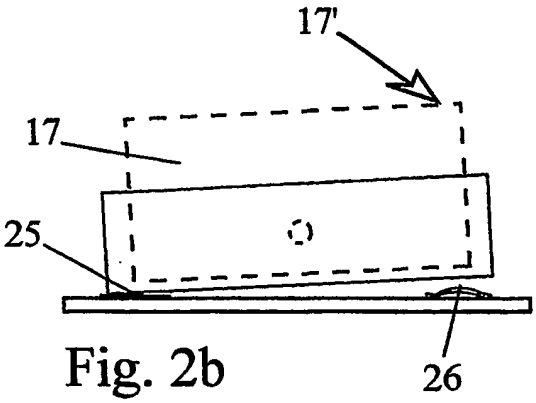

Fig. 2b

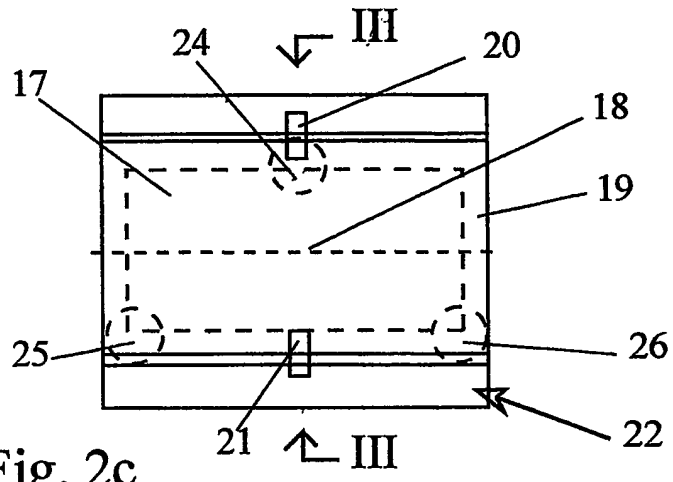

Fig. 2c

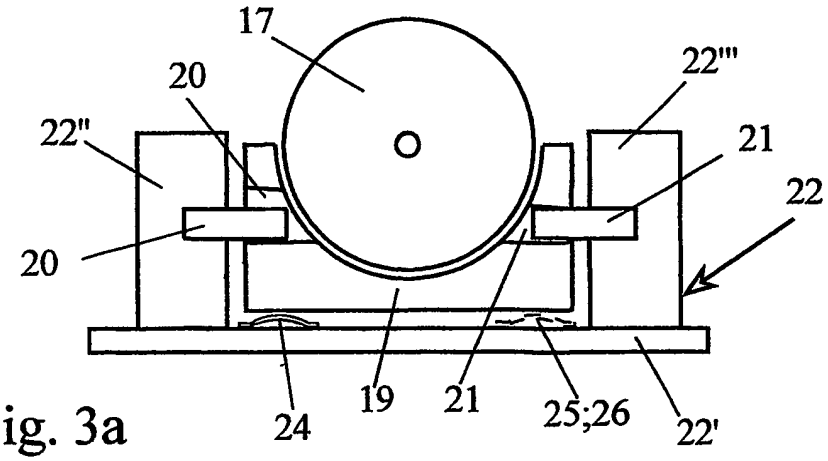

Fig. 3a

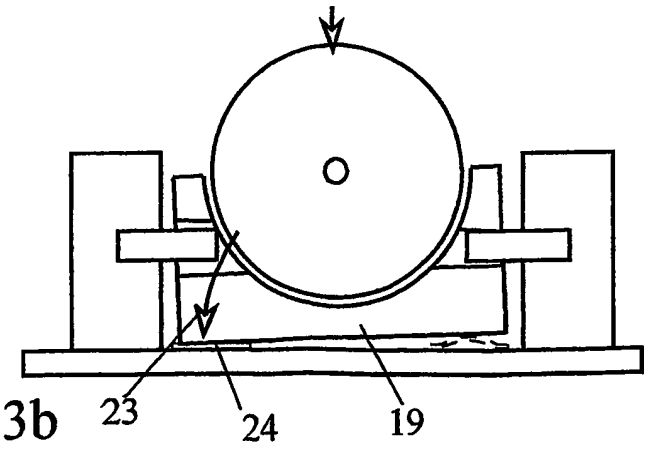

Fig. 3b

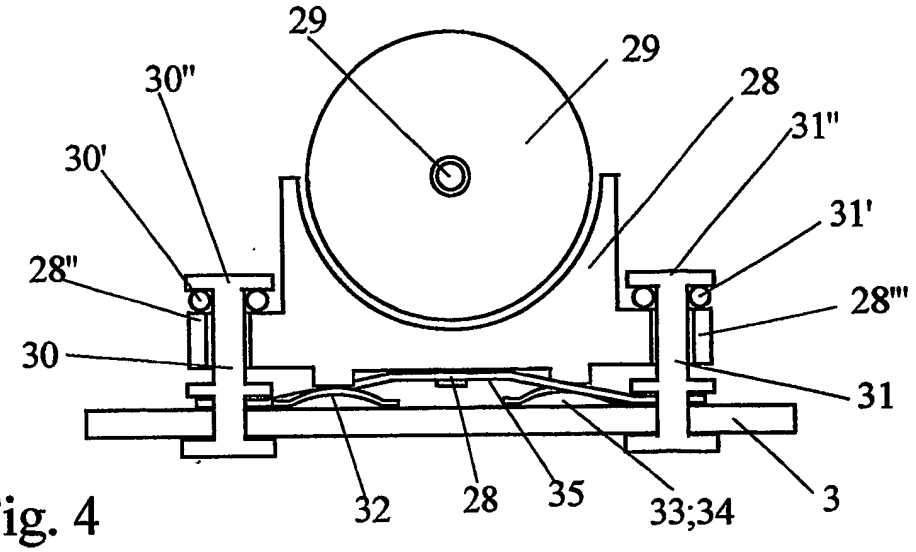
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Fig. 4

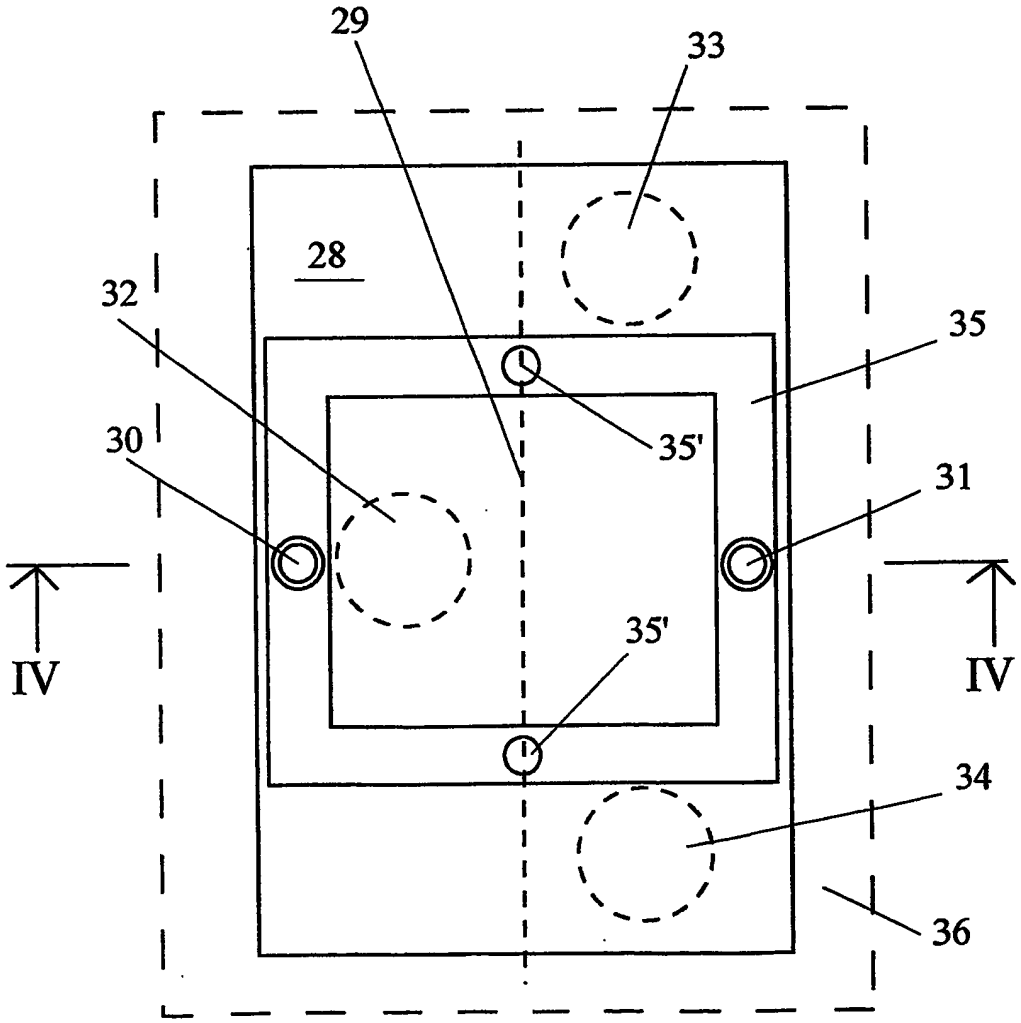
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Fig. 5

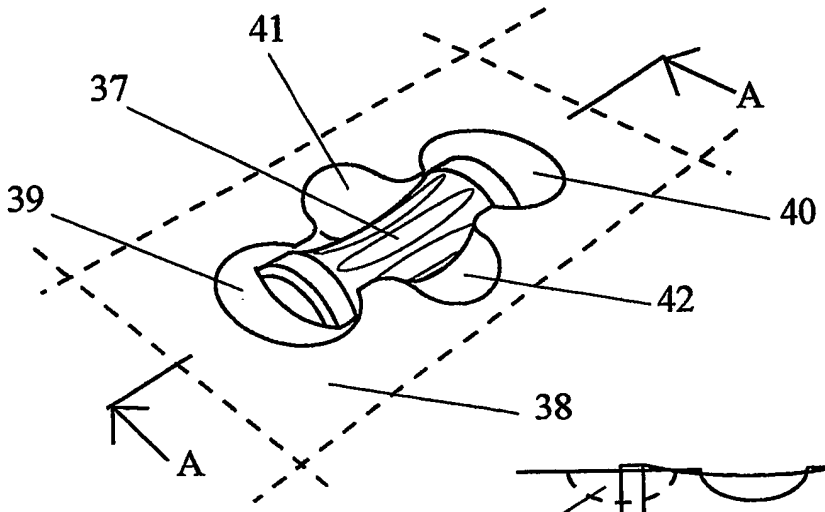


Fig. 6c

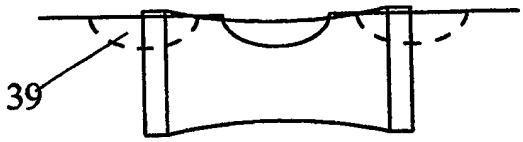


Fig. 6a

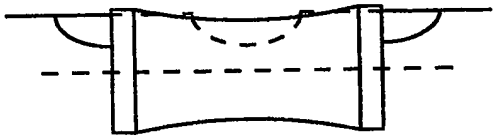


Fig. 6b

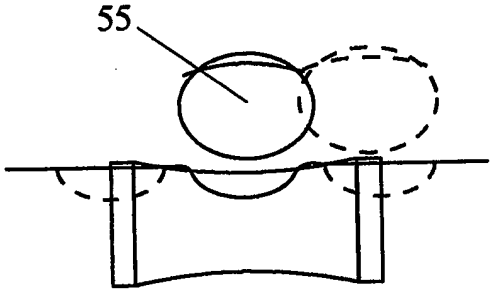


Fig. 6d

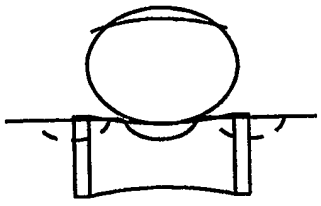


Fig. 6e

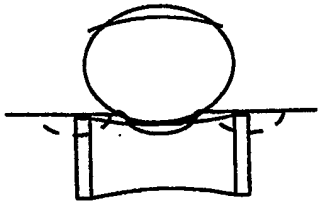


Fig. 6f

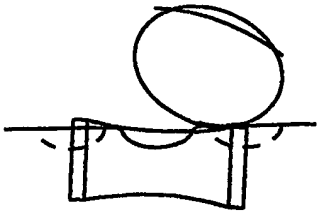


Fig. 6g

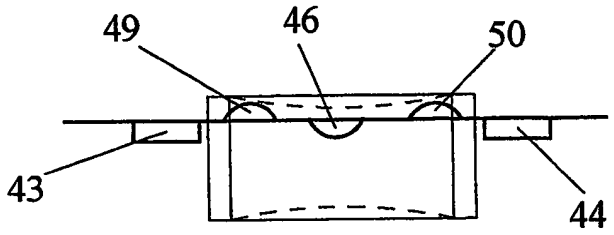


Fig. 6h

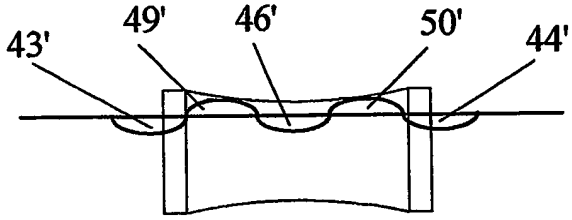


Fig. 6i

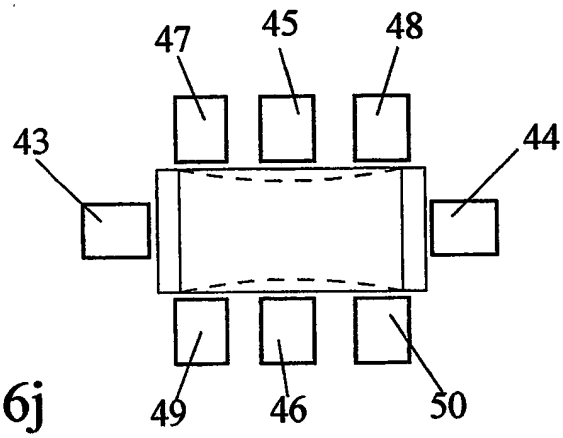


Fig. 6j

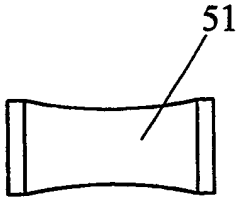


Fig. 6k

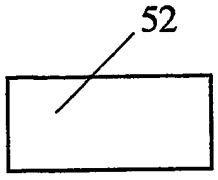


Fig. 6l

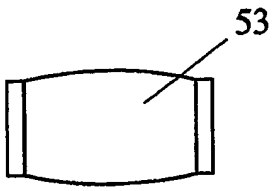


Fig. 6m

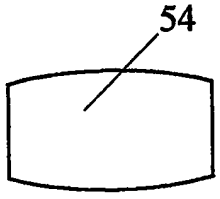


Fig. 6n

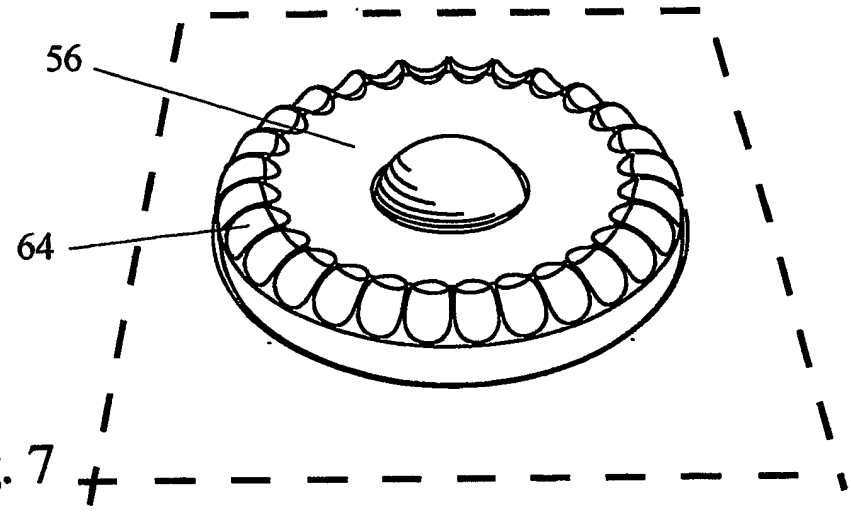


Fig. 7

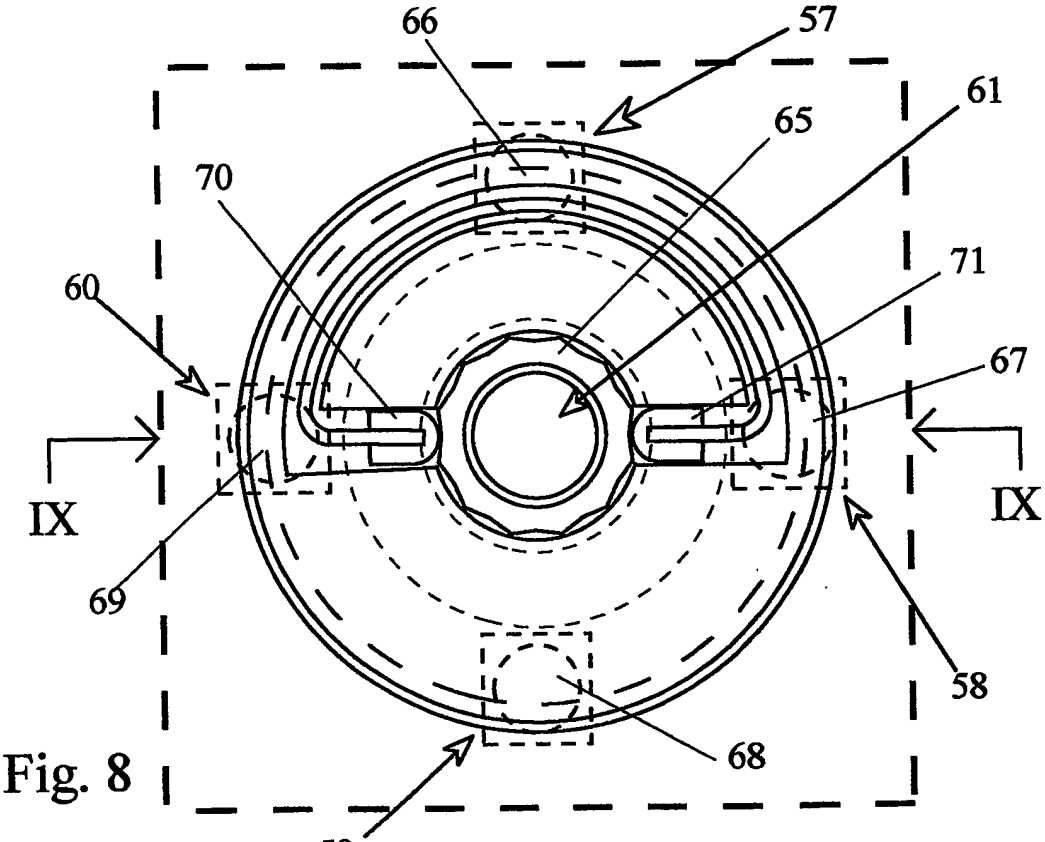


Fig. 8

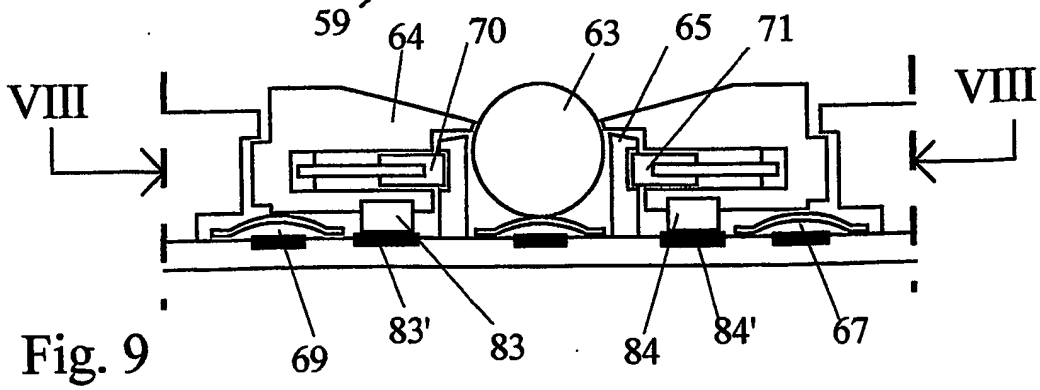


Fig. 9

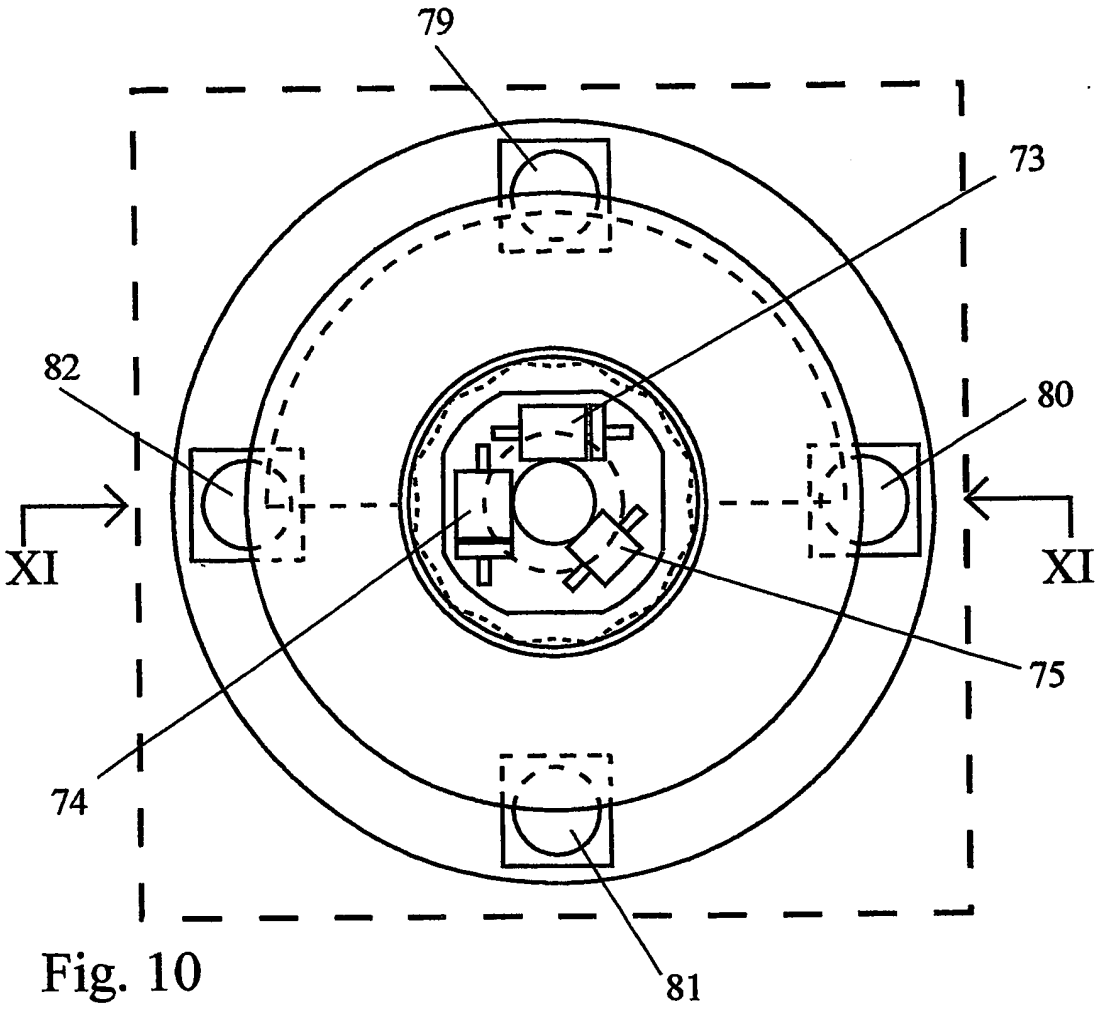


Fig. 10

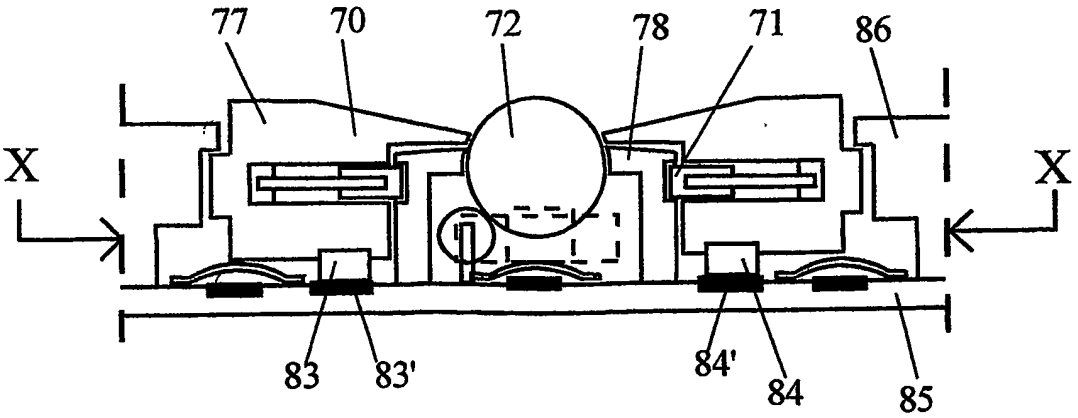


Fig. 11

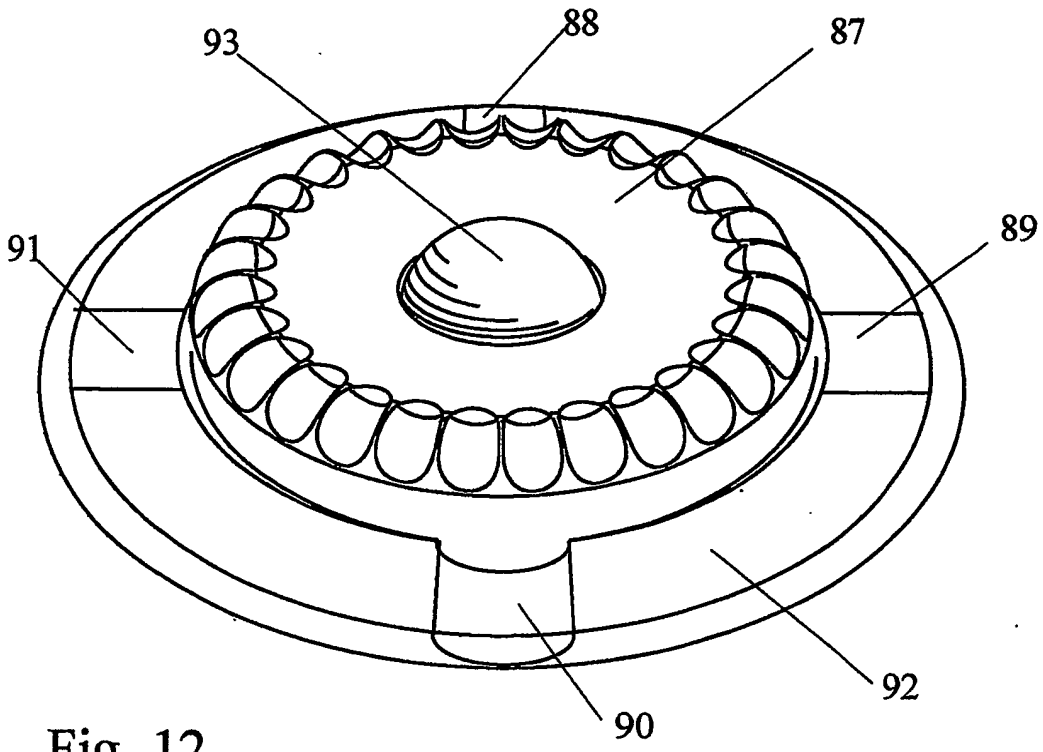


Fig. 12

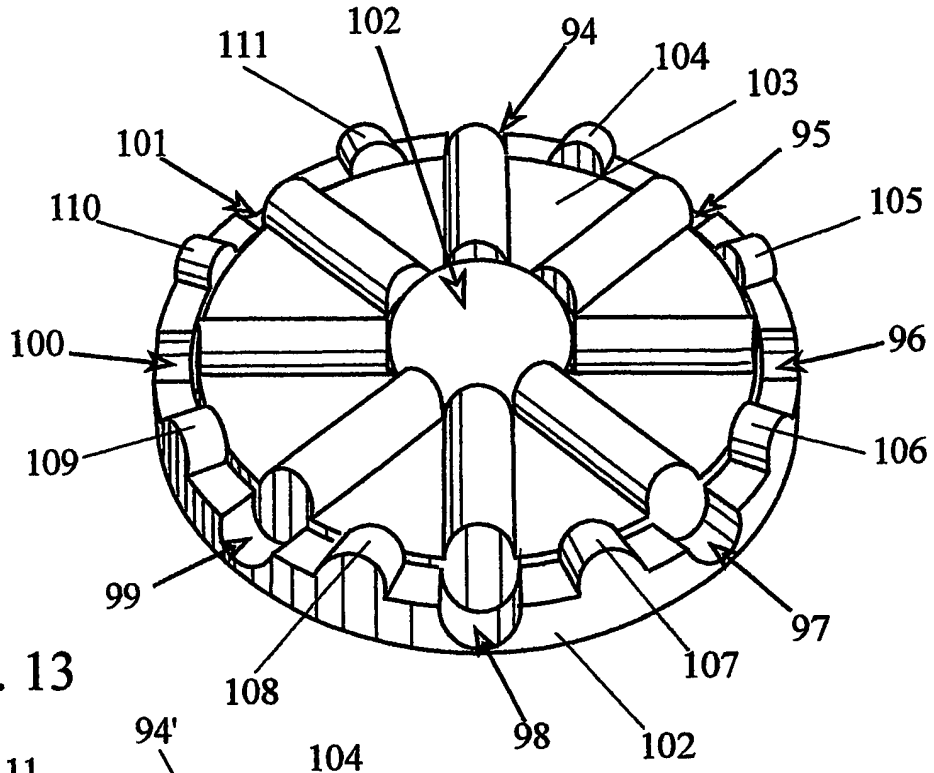


Fig. 13

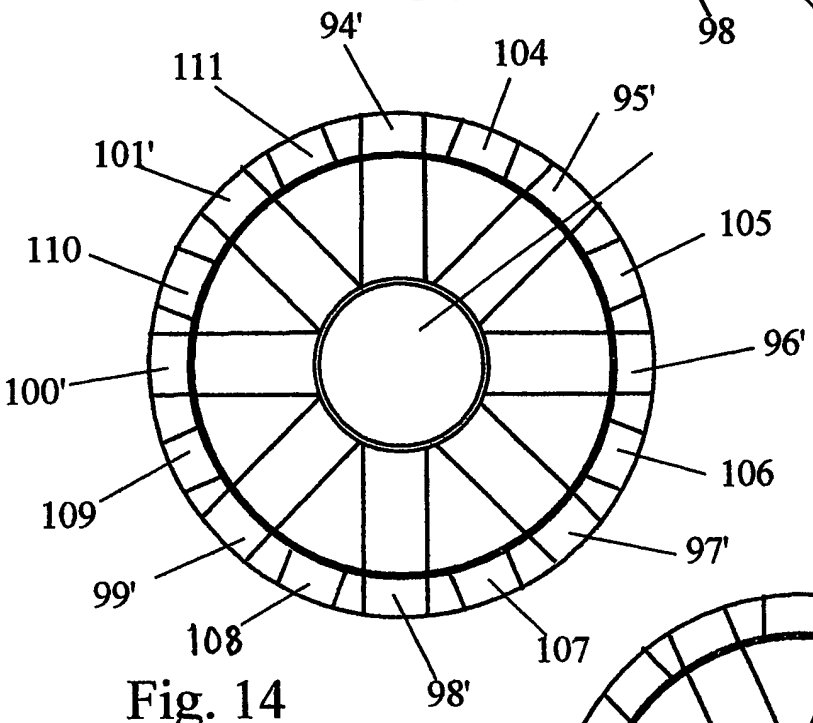


Fig. 14

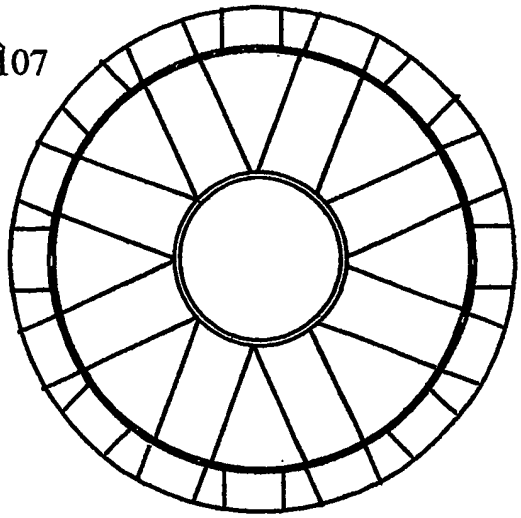


Fig. 15

Fig. 16b

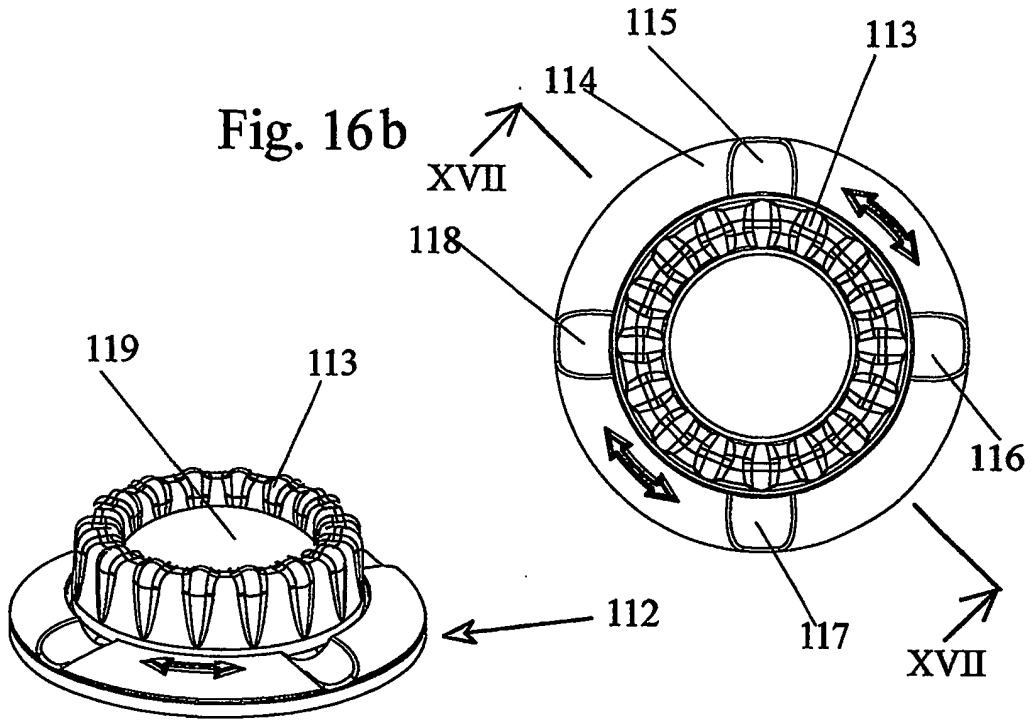


Fig. 16a

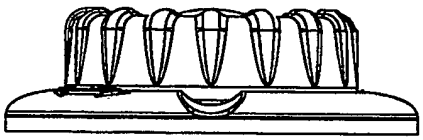


Fig. 16c

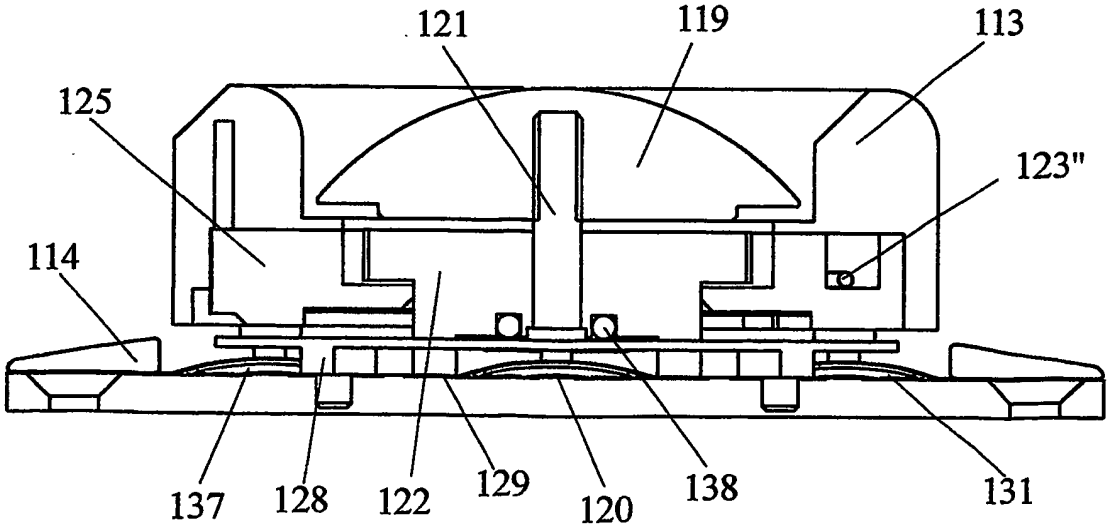
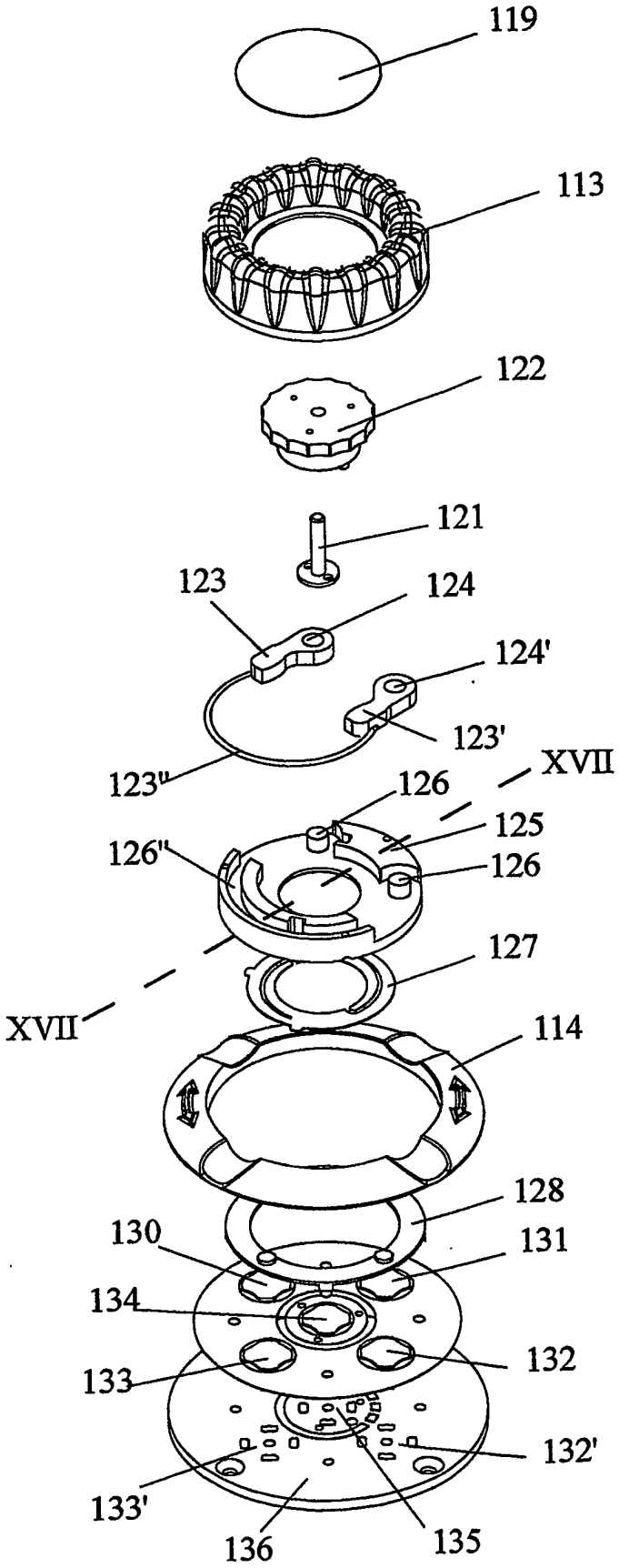


Fig. 17

Fig. 18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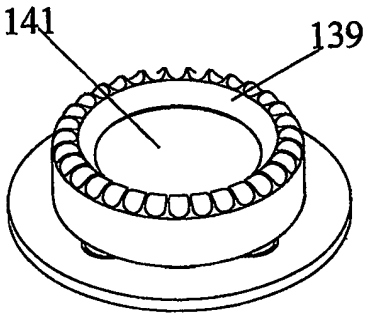

Fig. 19a

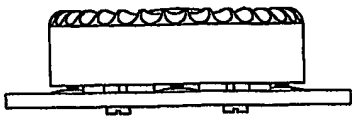

Fig. 19b

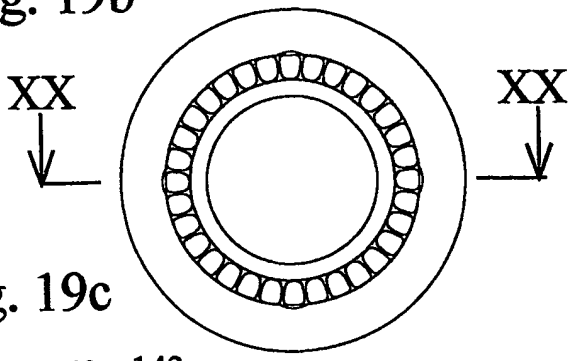

Fig. 19c

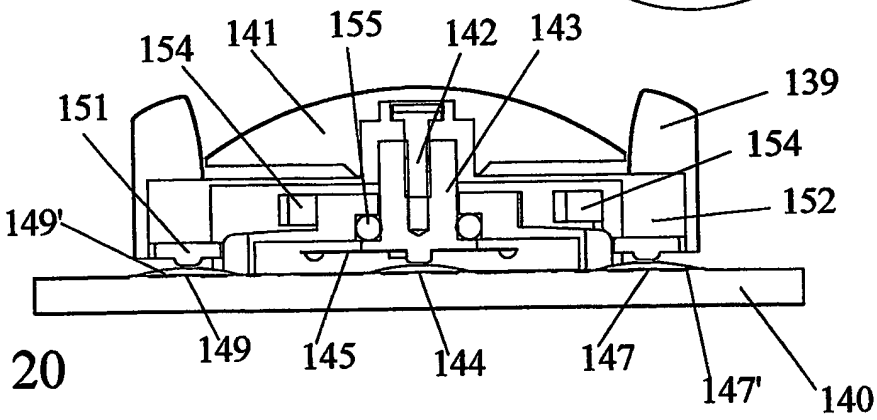

Fig. 20

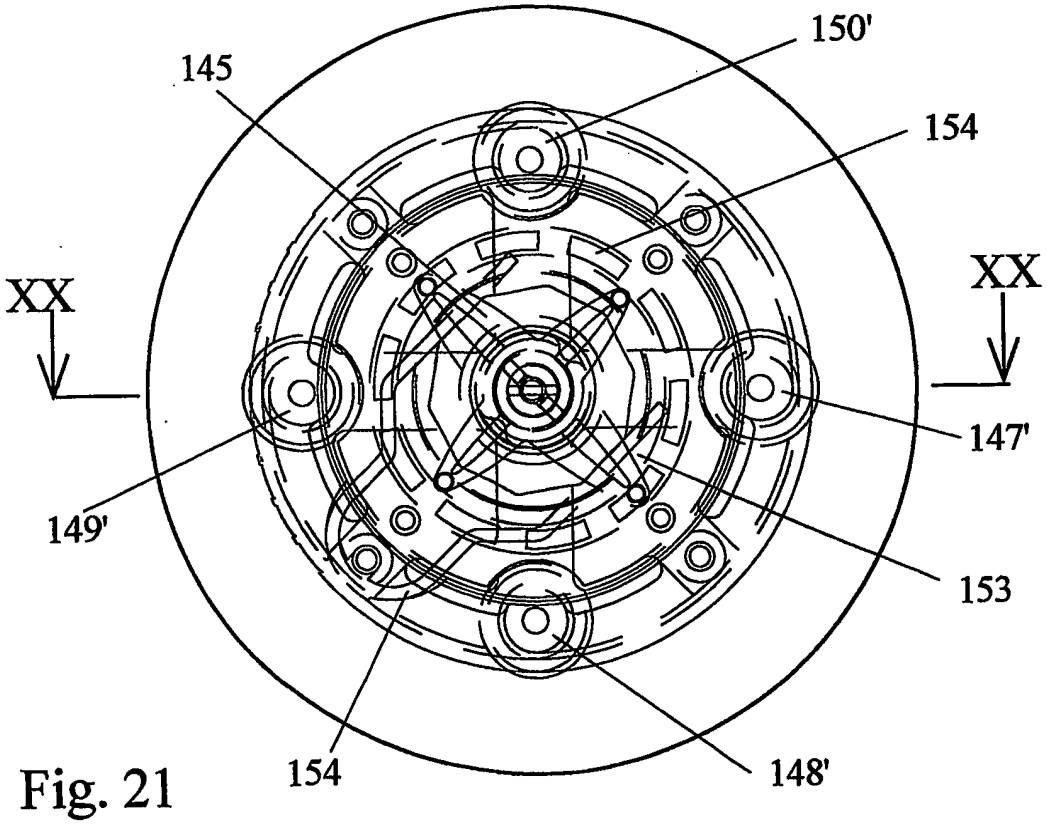

Fig. 21

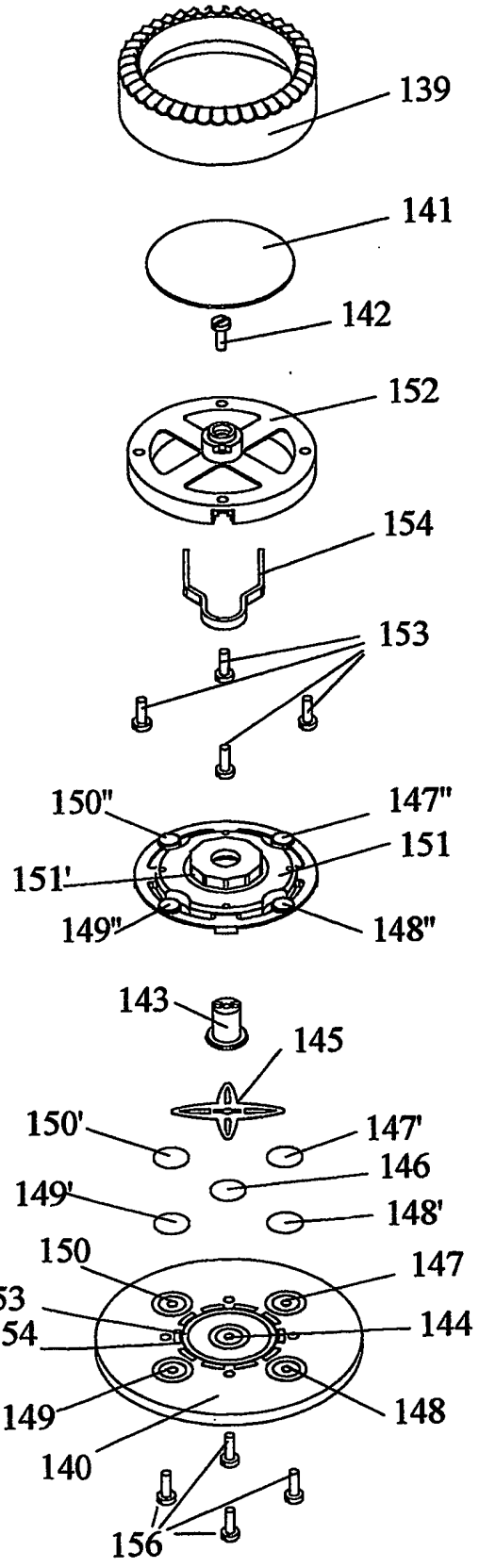
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Fig. 22

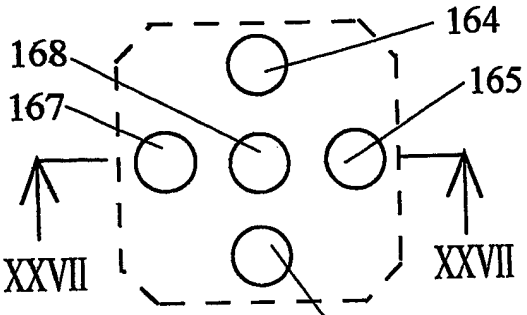

Fig. 26

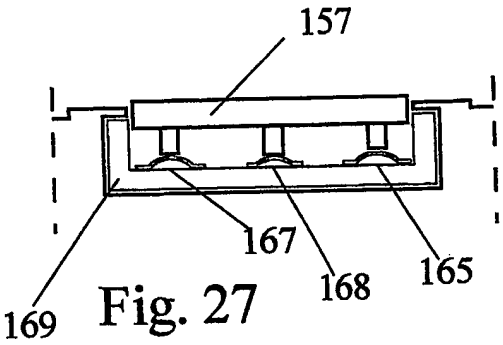

Fig. 27

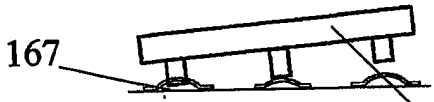

Fig. 28a

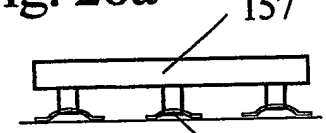

Fig. 28b

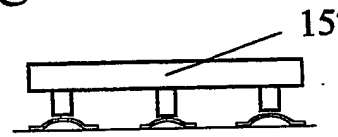

Fig. 28c

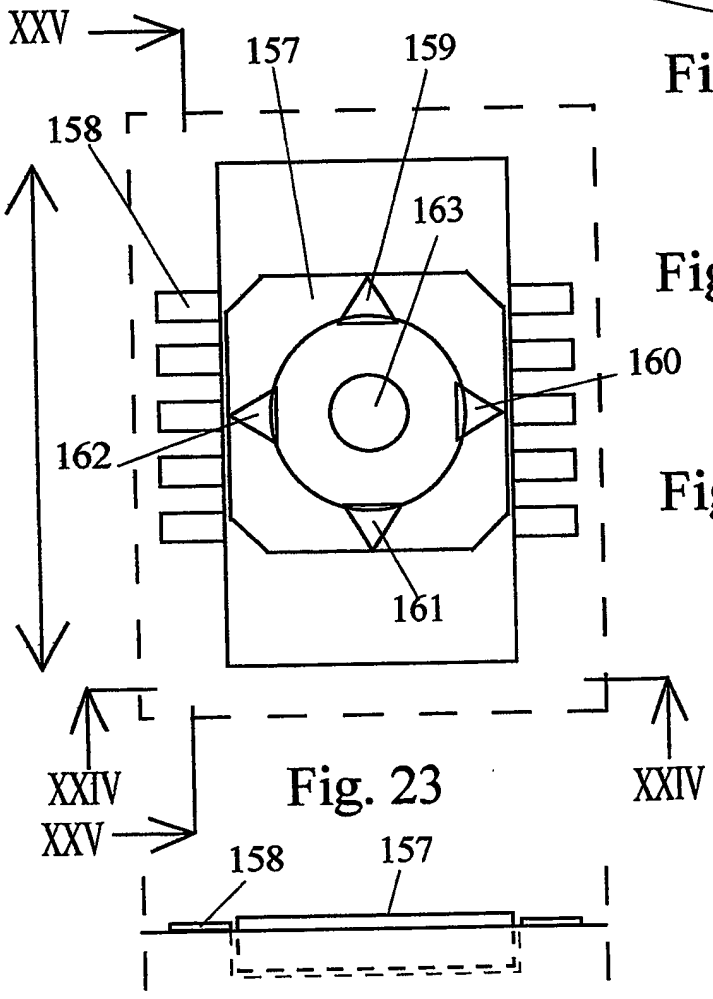

Fig. 23

Fig. 24

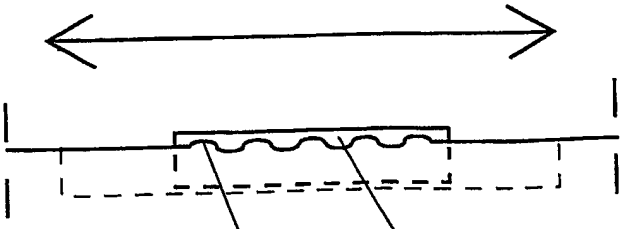

Fig. 25

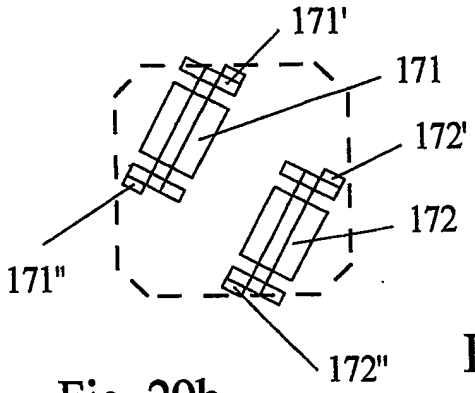

Fig. 29b

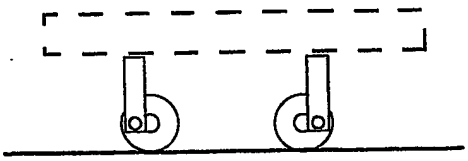

Fig. 29c

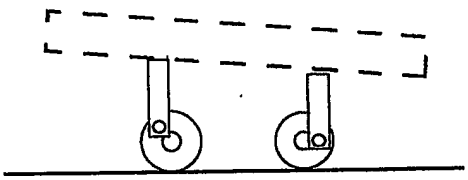

Fig. 29d

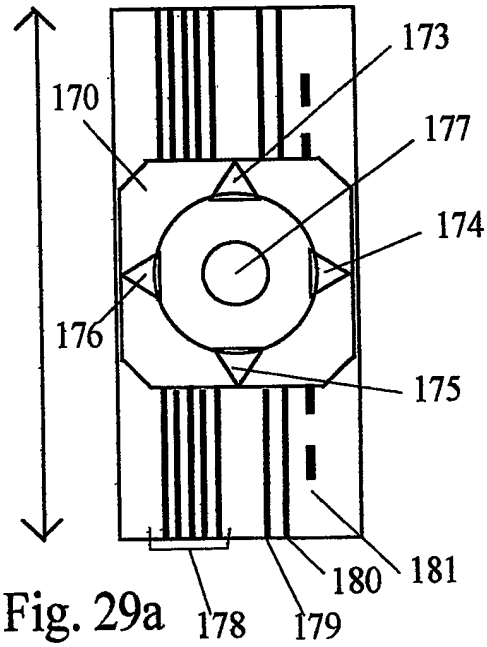

Fig. 29a

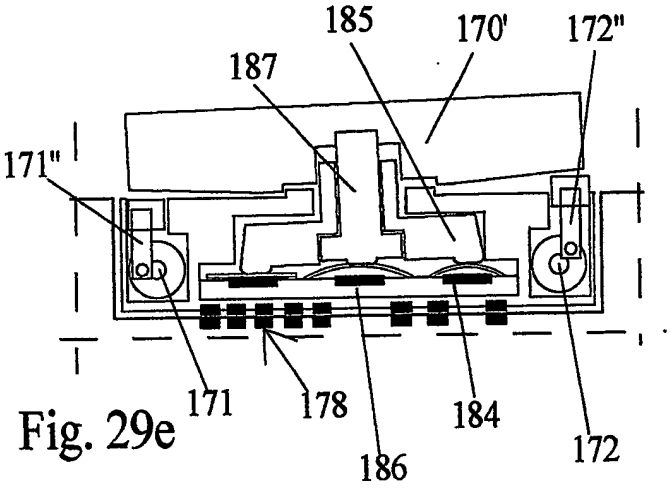

Fig. 29e

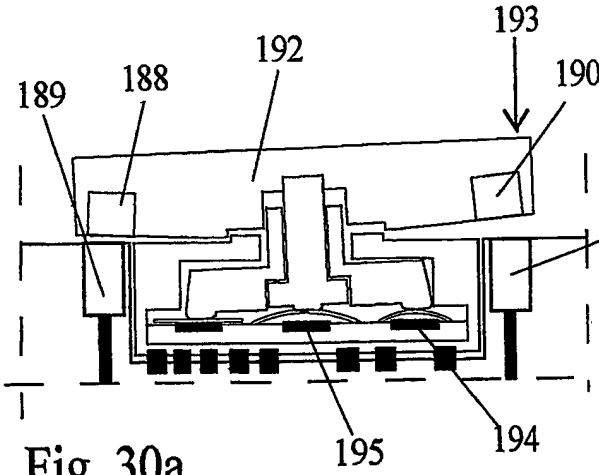

Fig. 30a

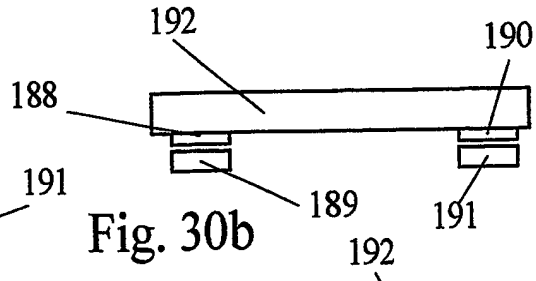

Fig. 30b

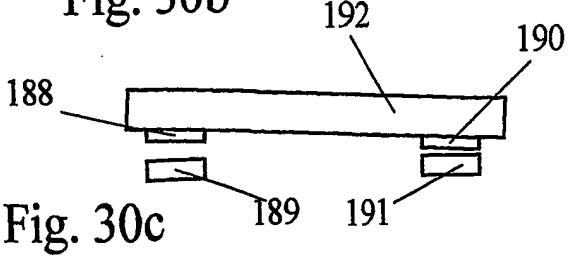

Fig. 30c

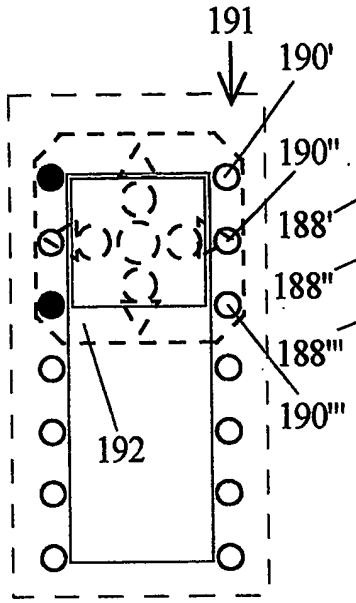

Fig. 30d

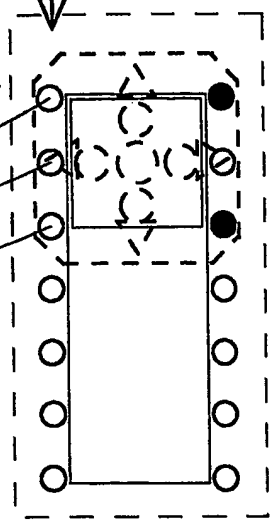

Fig. 30e

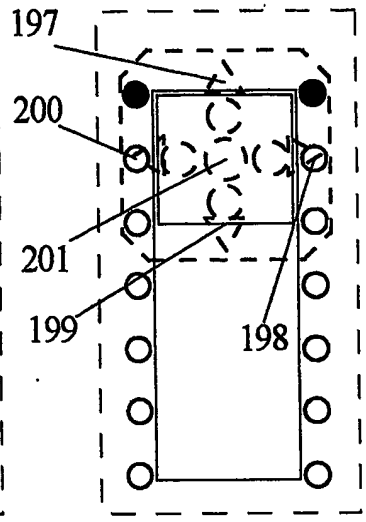

Fig. 30f

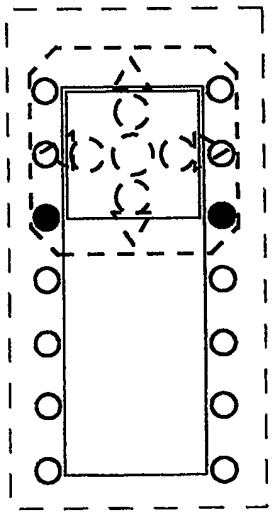

Fig. 30g

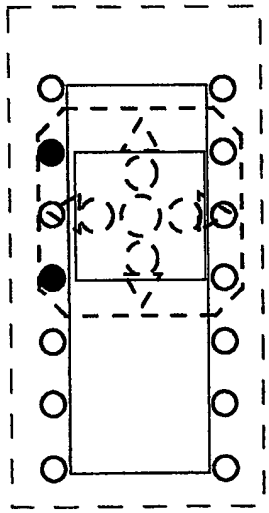

Fig. 30h

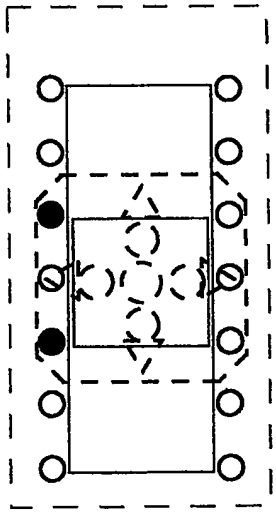

Fig. 30i

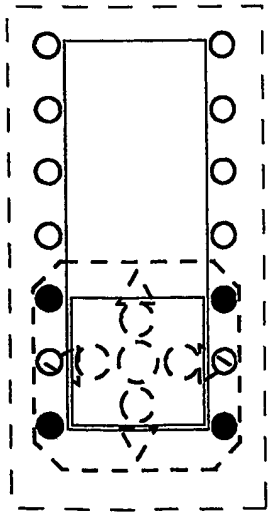

Fig. 30j

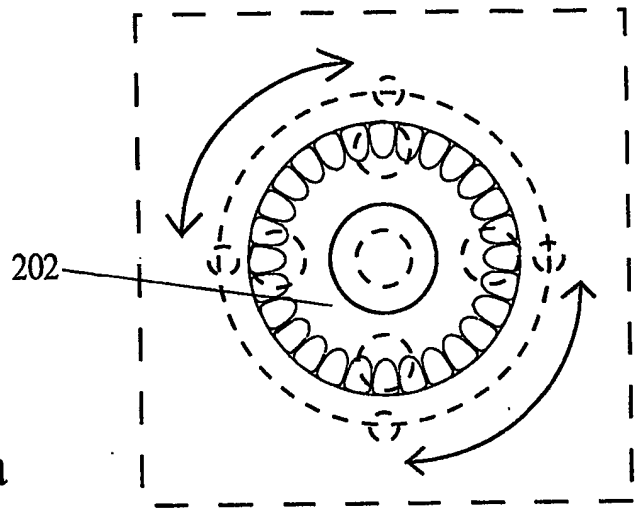

Fig. 31a

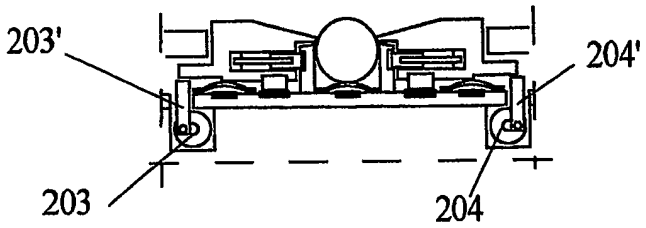

Fig. 31b

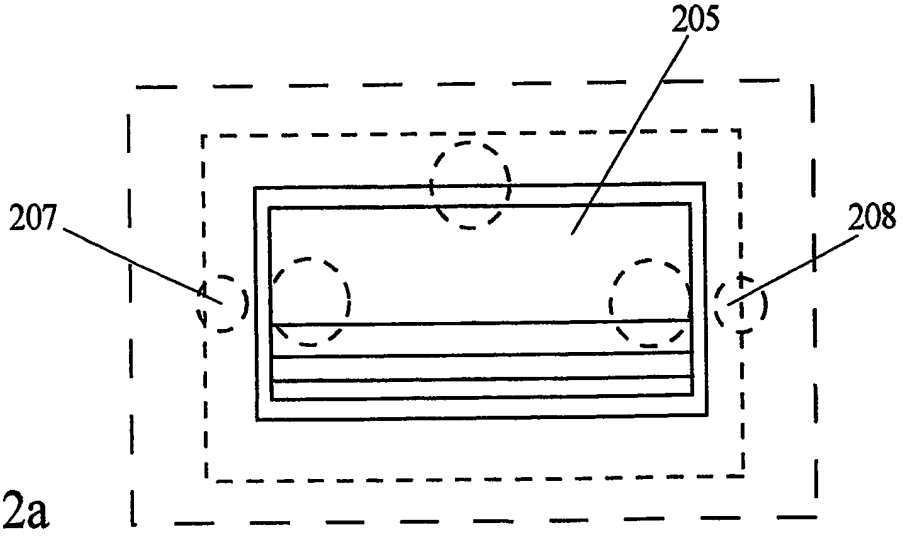

Fig. 32a

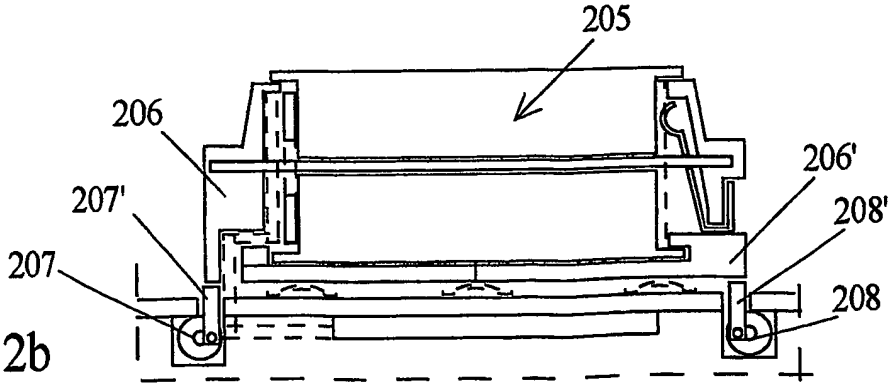

Fig. 32b

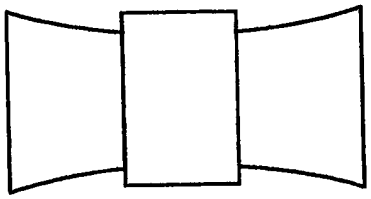

Fig. 33

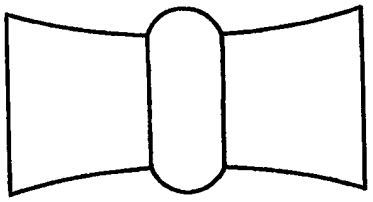

Fig. 34

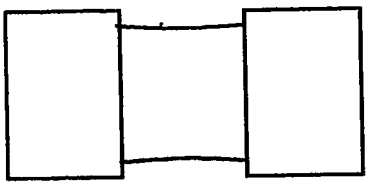

Fig. 35

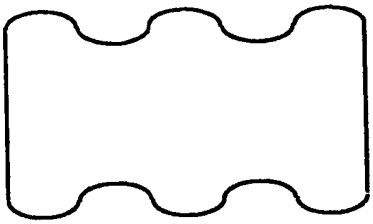

Fig. 36

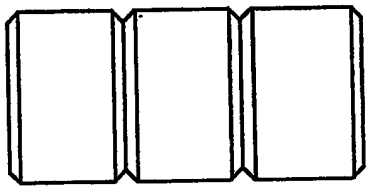

Fig. 37

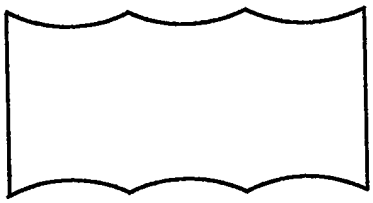

Fig. 38

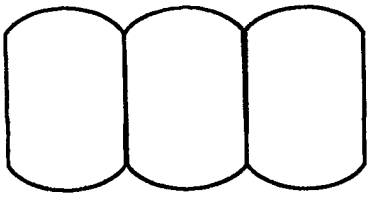

Fig. 39

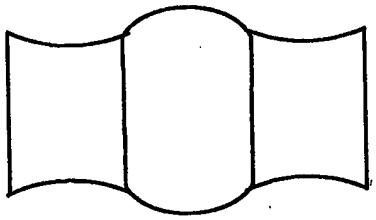

Fig. 40

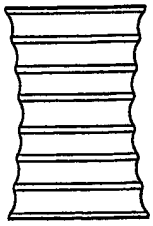
Fig. 41a

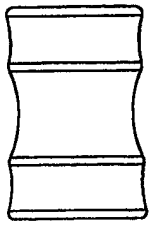
Fig. 42a

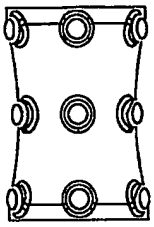
Fig. 43a

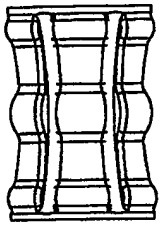
Fig. 44a

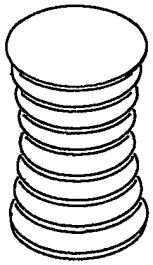
Fig. 41b

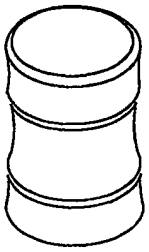
Fig. 42b

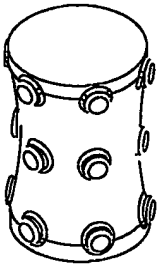
Fig. 43b

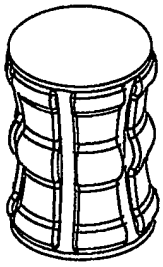
Fig. 44b

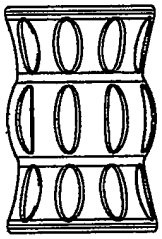
Fig. 45a

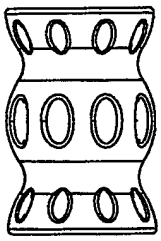
Fig. 46a

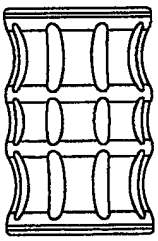
Fig. 47a

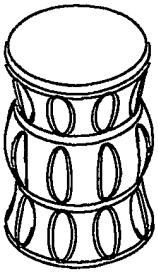
Fig. 45b

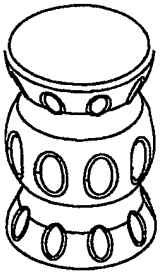
Fig. 46b

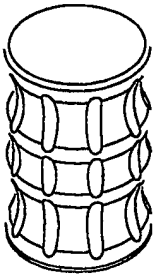
Fig. 47b

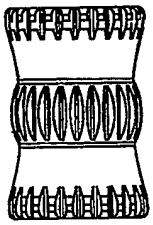

Fig. 48a

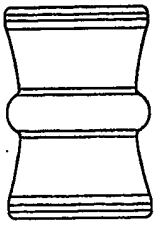

Fig. 49a

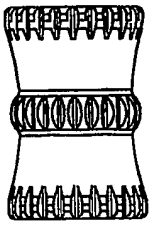

Fig. 50a

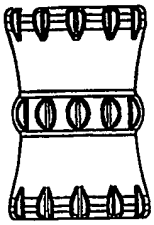

Fig. 51a

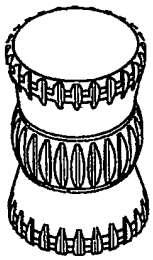

Fig. 48b

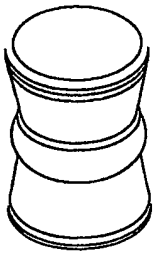

Fig. 49b

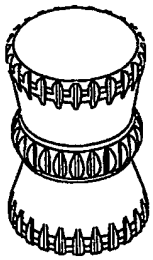

Fig. 50b

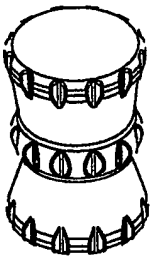

Fig. 51b

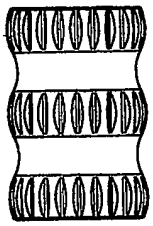

Fig. 52a

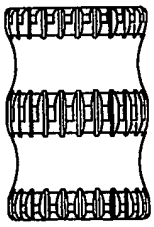

Fig. 53a

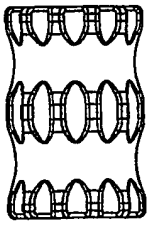

Fig. 54a

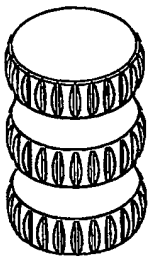

Fig. 52b

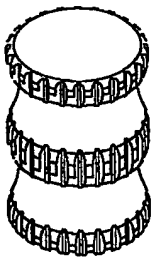

Fig. 53b

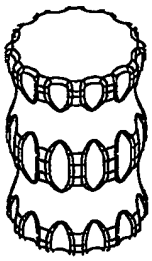

Fig. 54b

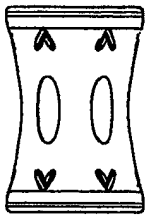

Fig. 55a

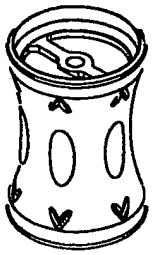

Fig. 55b

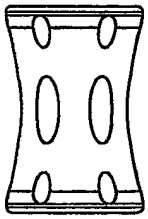

Fig. 56a

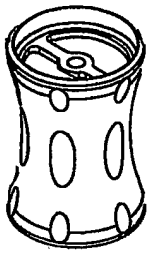

Fig. 56b

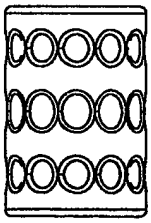

Fig. 57a

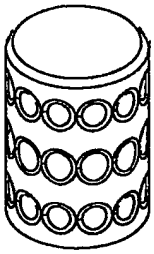

Fig. 57b

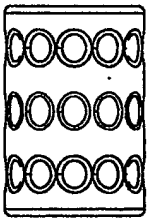

Fig. 58a

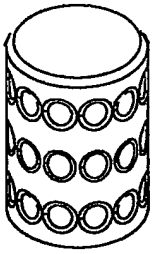

Fig. 58b

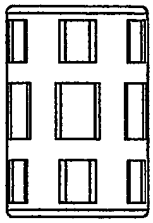

Fig. 59a

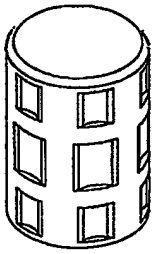

Fig. 59b

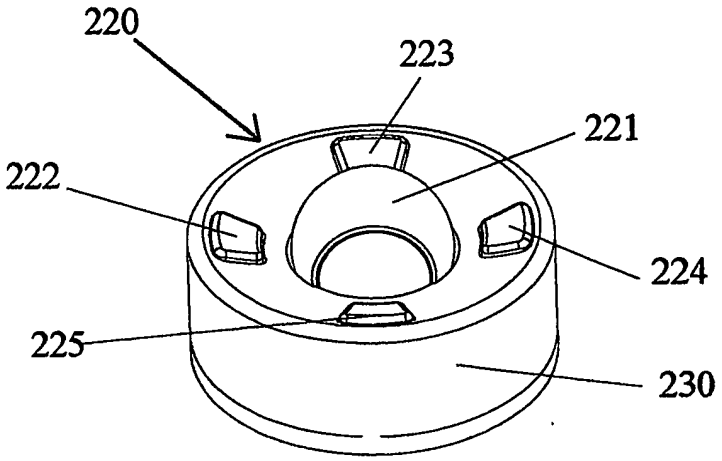

Fig. 60a

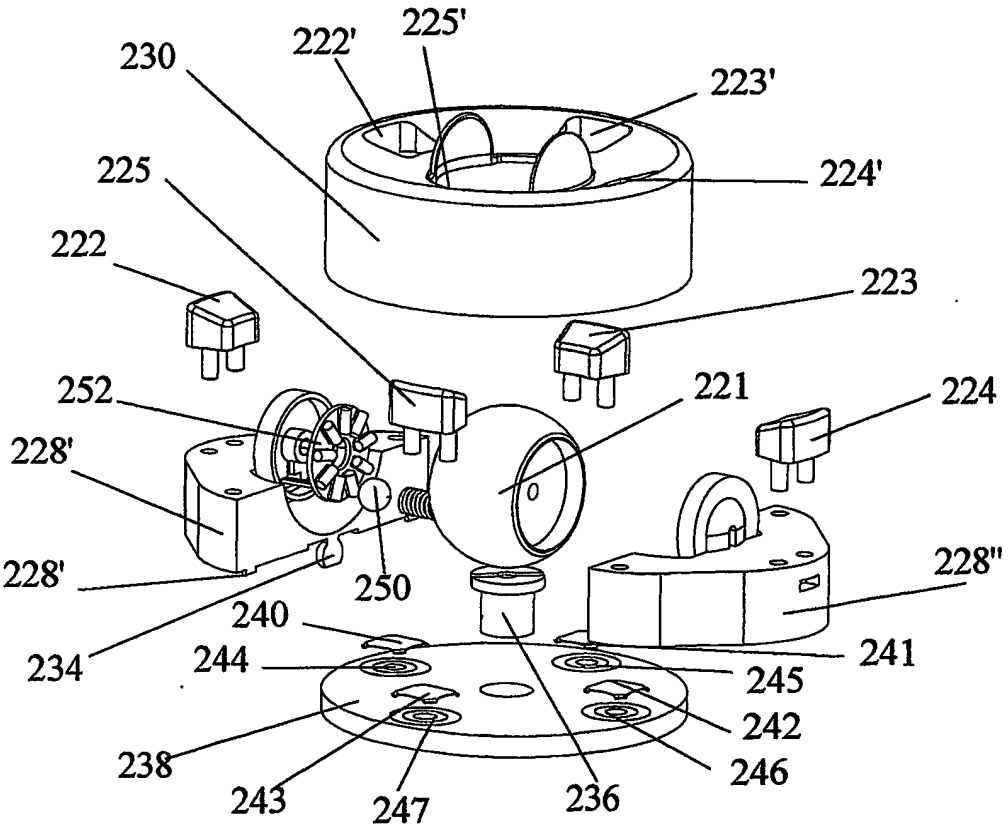

Fig. 60b

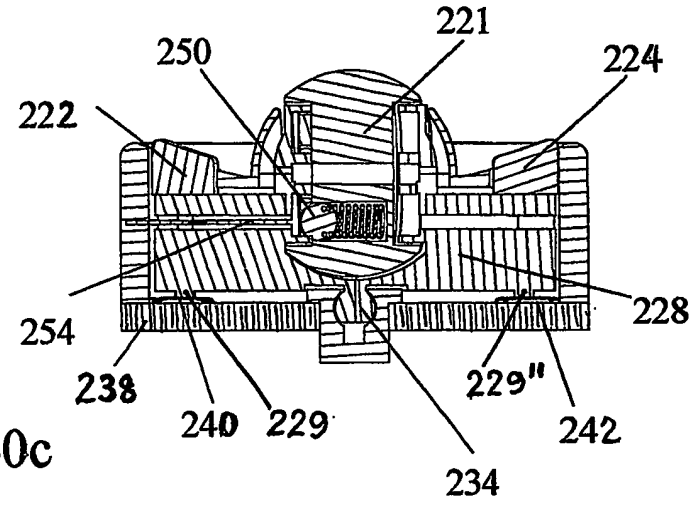

Fig. 60c

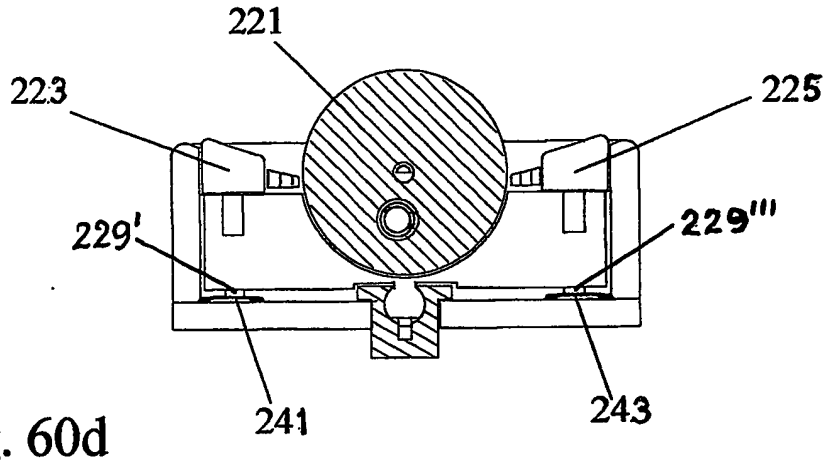

Fig. 60d

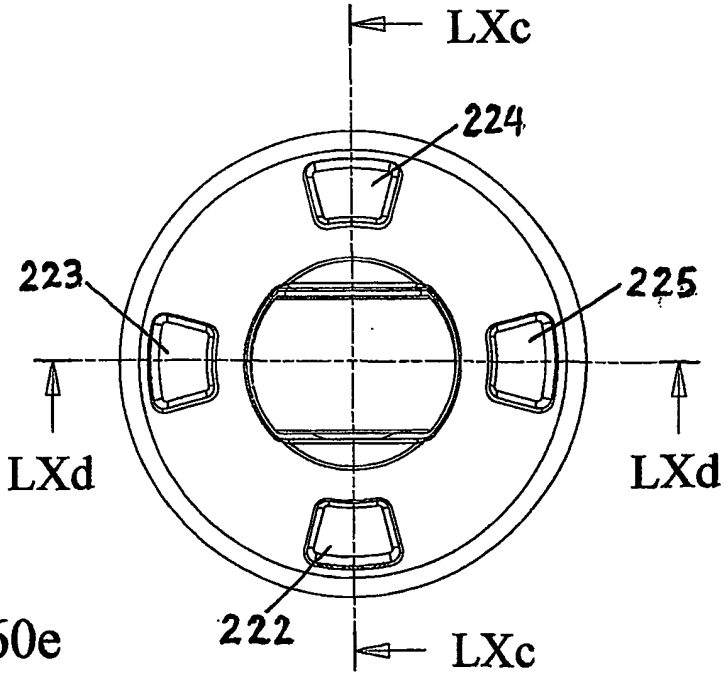

Fig. 60e

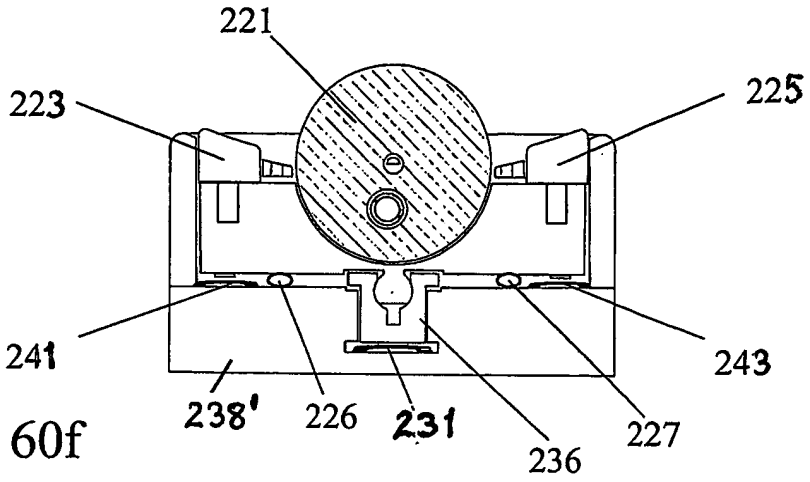

Fig. 60f

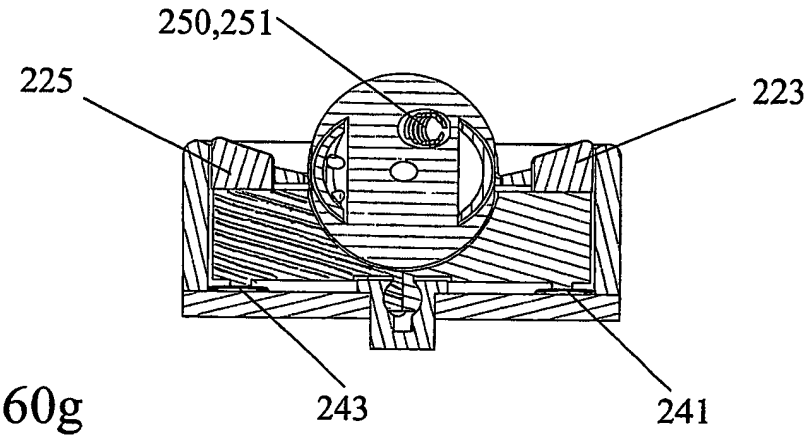

Fig. 60g

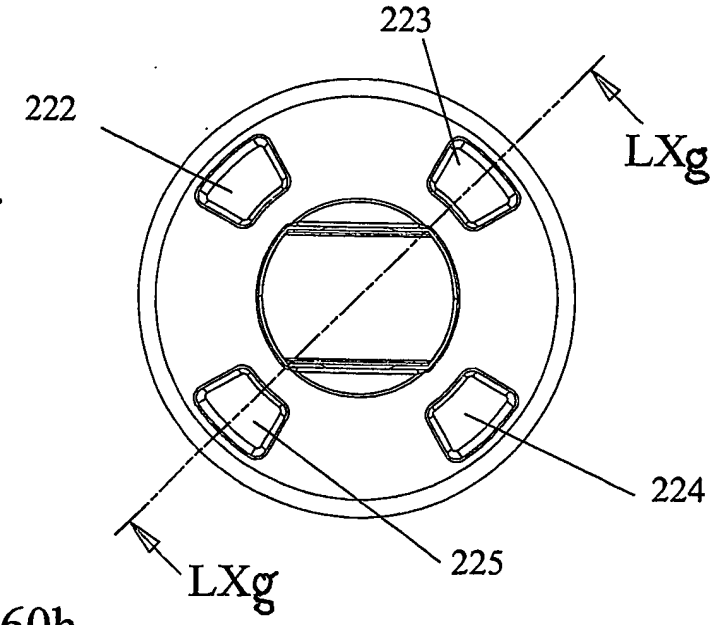

Fig. 60h

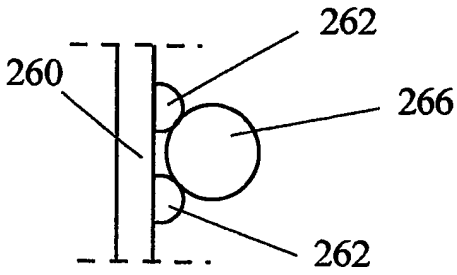

Fig. 61a

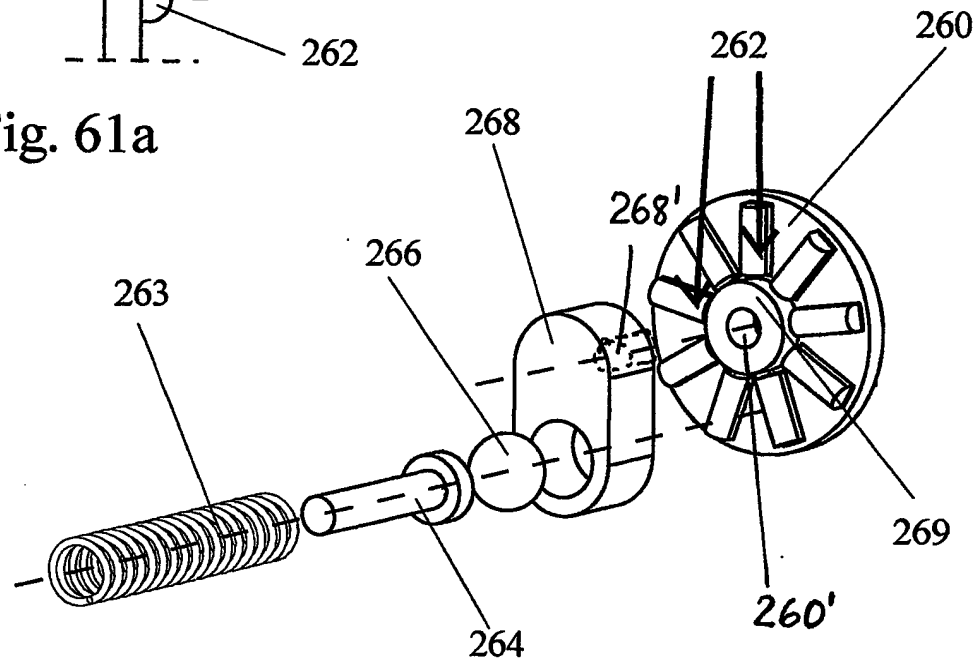

Fig. 61b

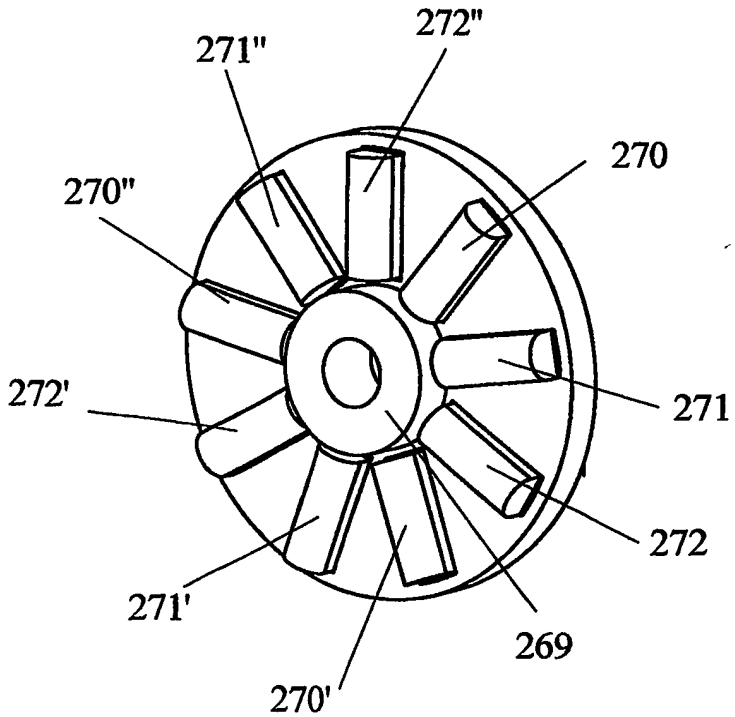

Fig. 61c

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 02/00451

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06K 11/18, G06F 3/033
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06K, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0141402 A2 (BADARNEH, Z.), 7 June 2001 (07.06.01), page 8, line 20 - page 42, line 7, abstract, figures 5-6,10,12,14K-48K,56A-68C; claims 9-26,28	1-48
A	US 5473325 A (MCALINDON, P.J.), 5 December 1995 (05.12.95), column 1, line 40 - line 64; column 3, line 14 - column 4, line 60; column 7, line 50 - column 8, line 28, figures 1-8, claims 1-19, abstract	1-48
A	EP 1073004 A2 (NOKIA MOBILE PHONES LTD.), 31 January 2001 (31.01.01), figures 1-5A, claims 1-26, abstract, the whole document	1-48

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 February 2003	21 -02- 2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ismar Hadziefendic /OGU Telephone No. +46 8 782 25 00

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 19936257 A1 (GEISER, G.), 1 February 2001 (01.02.01), figures 1-4, claims 1-13, abstract --	1-24,32-48
A	WO 0135203 A1 (BADARNEH, Z.), 17 May 2001 (17.05.01), page 1, line 1 - page 9, line 20, figures 1-33, claims 1-18, abstract -- --------	1-48

Box I **Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II **Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

In the International Searching Report multiple (groups of) inventions in this international application have been found, as follows:

Invention I: Claims 1-24, 32-48 define a manoeuvring device for controlling user functions in an electronic appliance with a display unit, where the device is endowed with stepwise rotatable cylinder shaped controlling device.

Invention II: Claims 25-31 describe a manoeuvring device for controlling user functions in an electronic appliance with a display unit, where the device is mounted on a stepwise movable slider movable along a path.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0141402 A2	07/06/01	AU 1312401 A	06/06/01
		AU 1743101 A	12/06/01
		BR 0015497 A	23/07/02
		EP 1228417 A	07/08/02
		EP 1236336 A	04/09/02
		NO 996001 D	00/00/00
		NO 20004375 A	07/06/01
		NO 20004770 A	25/03/02
		NO 20005610 A	08/05/02
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		NO 20022698 A	06/06/02
		US 2003001816 A	02/01/03
		WO 0135203 A	17/05/01
US 5473325 A	05/12/95	NONE	
EP 1073004 A2	31/01/01	US 6480185 B	12/11/02
DE 19936257 A1	01/02/01	WO 0109909 A	08/02/01
WO 0135203 A1	17/05/01	AU 1312401 A	06/06/01
		BR 0015497 A	23/07/02
		EP 1228417 A	07/08/02
		NO 995520 D	00/00/00
		NO 20005610 A	08/05/02
		NO 20022211 A	08/05/02
		AU 1743101 A	12/06/01
		EP 1236336 A	04/09/02
		NO 996001 D	00/00/00
		NO 20004375 A	07/06/01
		NO 20004770 A	25/03/02
		NO 20022698 A	06/06/02
		US 2003001816 A	02/01/03
		WO 0141402 A	07/06/01